MACHINERY

Volume 45 NEW YORK, MAY, 1939 Number 9

The Electric Eye in Industry

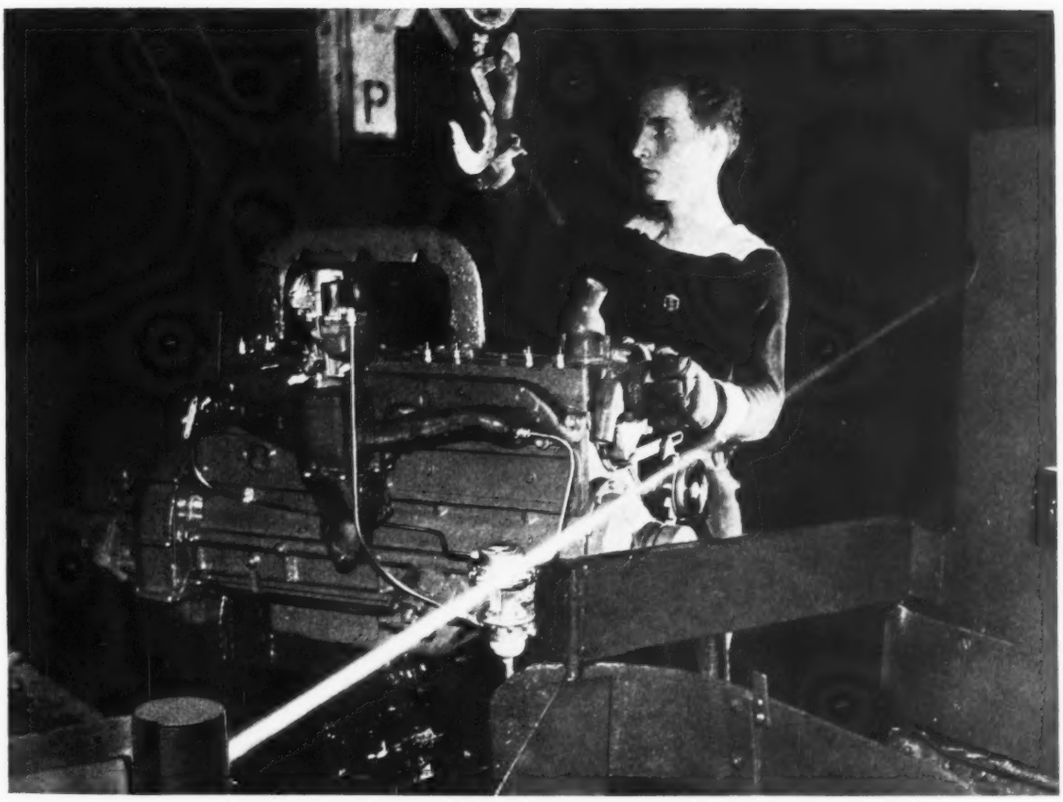


Photo-Electric Cells are Used to Start Machines, Govern the Length of Time that Work is Subjected to Heating Temperatures, Determine whether Parts Meet Certain Inspection Requirements, and Insure Desired Operating Conditions in Many Other Cases

By CHARLES O. HERB

THE popular imagination has been stirred in recent years by the development of the photo-electric cell or electric eye. Unseen hands open a door when a person or an automobile approaches, prevent an elevator door from closing while someone is entering, take "photo finishes" of horse races, and protect crown jewels on display by sounding an alarm in case of attempted theft. This is modern magic! But the application of the electric eye in industry, though not so generally known, is of much greater extent and perhaps of even more value. It has proved to be a practical and thoroughly reliable device for controlling the operation of machines and other mechanical equipment under certain prescribed conditions. Typical industrial applications of the electric eye made by the Electronic Control Corporation, Detroit, Mich., will be described in this article.

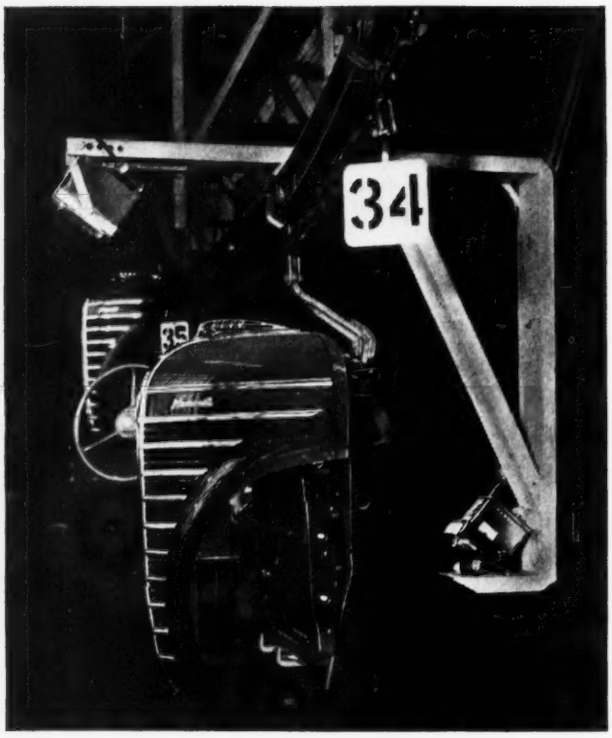


Fig. 1. Electric Eyes Control the Operation of Conveyors that Bring Sub-assemblies and Parts to the Plymouth Assembly Lines, Insuring that Parts are Held at Unloading Points until Removed

Engines for the automobiles built by the Pontiac Motor Division of the General Motors Corporation are fed to the final assembly line from a conveyor line on the overhead mezzanine, being lowered by a hoist through an opening in the ceiling. Provision is necessary to insure immediate stopping of the engine conveyor on the mezzanine in the event that an engine block is not removed when it reaches the end of the line. To accomplish this, an electric eye control was installed, as shown in the heading illustration.

Ordinarily, a beam of light passes across the conveyor line from a light source to an electric eye, and as long as the light beam remains uninterrupted, as shown in the heading illustration, the conveyor motor keeps running. However, should the man who lowers the automobile engines to the final assembly conveyor with a hoist fail to remove an engine, it will interrupt the light beam, thus energizing a relay which operates a solenoid switch and stops the conveyor motor.

When the automobile engine is removed and the beam of light again permitted to pass to the electric eye, the conveyor motor will be restarted automatically and continue running until the light beam is again interrupted. This electric eye control will function indefinitely, whereas the mechanical device formerly used for the purpose had to be replaced frequently because of rapid wear.

Electric eyes are used in a somewhat similar manner along the assembly lines of the Plymouth Motor Corporation, Detroit, Mich., to stop the feeder lines when the assemblers fail to remove a fender, steering column assembly, radiator shell, or other part at the correct moment, thus causing a light beam passing to an electric eye to be broken. The various automobile parts and sub-assemblies are routed to the assembly lines in the exact sequence required to suit the different types and colors of automobiles that come along the same assembly conveyors. Considerable confusion would result if, for example, a black engine hood were permitted to pass an assembler and the next one coming along the feeder line were maroon. The electric eye controls, of which there are eight along the assembly

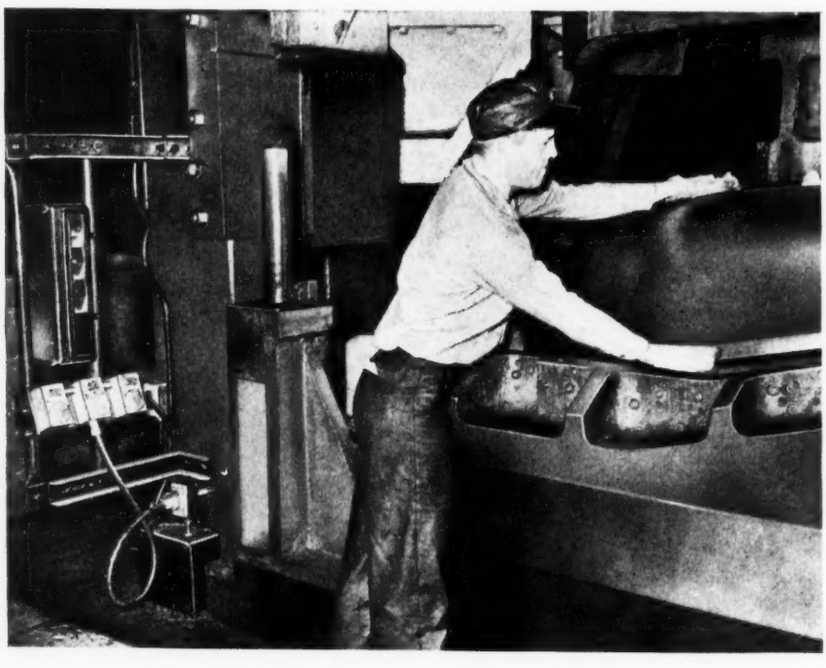
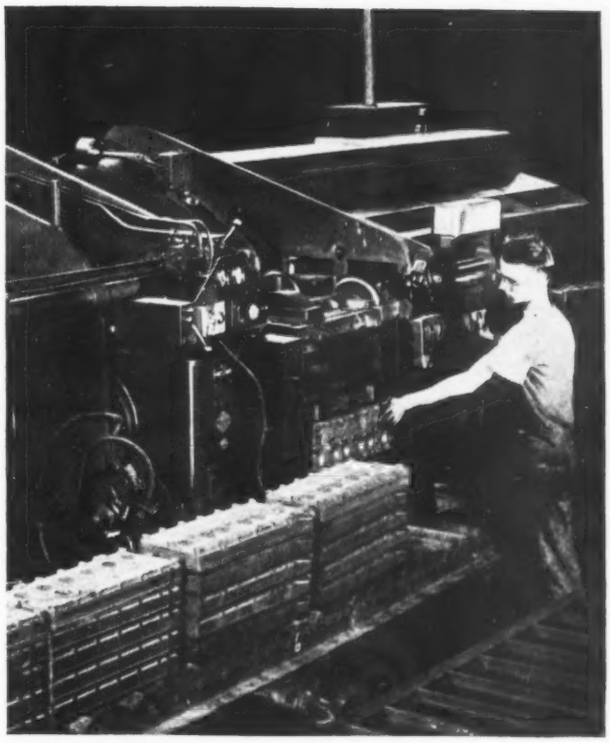


Fig. 2. Large Press in the Buick Stamping Plant, the Operation of which is Completely Guarded by "Curtains of Light" that Extend across the Front and Back of the Press to Photo-electric Cells

Fig. 3. Close-up View of the Work Fixture on a Huge Cylinder Head Broaching Machine Equipped with an Electric Eye that Prevents Operation if the Work is Improperly Loaded



lines, prevent parts from being carried away from the assemblers.

In the installation shown in Fig. 1, a beam of light is projected from the box seen at the upper left to an electric eye contained in the box at the lower right. At the time that the photograph was taken, this beam of light had been interrupted by a radiator assembly and the feeder line had stopped. When the radiator shell was removed and the beam of light again permitted to pass to the electric eye, the conveyor started up automatically. The feeder conveyors are operated at slightly faster speeds than the assembly lines, so as to insure that the required parts will always be on hand when they are needed.

Electric eyes can also be used to control the cutting off of long pieces of stock. In one such application, rolled stock is permitted to pass a cutting-off saw until the end of the stock intercepts a light beam. Immediately, the saw carriage commences traveling with the stock and the saw is fed transversely through the stock. When the piece has been cut off, the saw carriage returns to its starting position. In this manner, bars, tubes, etc., can be readily cut to uniform lengths.

On Power Presses, the Electric Eye Prevents Accidents and Reduces Operator Fatigue

Large blanking, drawing, and trimming presses are operated automatically and guarded against accidents by photo-electric cells. "Curtains of light" extend across the front and the back of the presses, and whenever an operator or one of his helpers intercepts these curtains of light, either to remove a finished stamping or unintentionally, the press is immediately stopped by the electric eyes, which energize relays, thus operating a solenoid switch and stopping the driving motor. The press cannot be operated again until the man or men have stepped out of the curtains of light. As soon as the curtains of light are clear, the press will operate automatically.

With this control, press operators are relieved of pushing electric buttons, except for the initial

Fig. 4. An Electric Eye on This Electric Resistance Heating Machine Shuts off the Electric Current when the Center of Automobile Front-axle King-pins has Obtained the Desired Annealing Temperature

starting of the machine, and there is absolute insurance against injury to operators. A typical installation on one of the presses at the plant of the Buick Motor Co., Flint, Mich., is shown in Fig. 2.

One of the outstanding machines in the truck engine plant recently built by the International Harvester Co. at Indianapolis, Ind., is a huge Cincinnati horizontal broaching machine which finishes the top and bottom of cylinder heads. This machine, as shown in Fig. 3, is equipped with a power-operated indexing fixture that enables the operator to load cylinder heads on one side of the fixture while heads on the other side are being broached.

A beam of light is normally projected from a box mounted on a bracket at the upper right of the indexing fixture across the fixture face to a photo-electric cell in a unit at the lower left of the fixture. However, if the cylinder heads are not correctly loaded on the fixture, this beam of light will be broken, the fixture prevented from indexing, and the machine stopped. By means of this electric eye installation, damage to the expensive broaches of the machine caused by misaligned work is completely avoided.

Using the Electric Eye to Control Work Temperatures

The front-axle king-pins for Pontiac automobiles are annealed for a length of 2 inches in the center after having been casehardened and tempered. The operation must be performed in a manner that insures localized annealing in the center of the part. This is successfully accomplished by heating the king-pins in the machine shown in Fig. 4, which operates on the electric resistance principle and is equipped with a photo-electric cell for controlling the temperature to which the pins are heated.

The operator clamps each king-pin between hydraulic dies, and current is then automatically passed through the pin until a temperature of 1100 degrees F. is reached in the center. At that temperature, the color of the king-pin is such as to cause the photo-electric cell to function, thus opening the primary circuit of the heating transformer and releasing the clamping dies. The pin drops from the dies into water, which prevents the high heat in the center from being transmitted to the ends of the pin. Six king-pins are annealed per minute with this equipment.

In the same plant, an electric eye is used, as shown in Fig. 5, to control the hardening of the tip on tappet valve stems. The valve stem is held vertically between two hydraulic clamps, which are actuated by depressing a foot-pedal to energize a solenoid switch that operates hydraulic valves. As soon as the valve stem is properly gripped, electric current is automatically applied to heat the stem tip to 1650 degrees F. When this temperature has been attained, as indicated by the color of the tip, the electric eye shuts off the current. After a predetermined time, the clamps release automatically, and the valve stem is removed for quenching. This equipment enables 1000 valve stems to be hardened an hour. The temperature of the heated tip is controlled within 10 degrees. It is essential that the heating be accomplished rapidly, to prevent the heat from traveling down the stem toward the head; the heating period lasts only 1/2 second.

The Electric Eye as a Reliable Inspection Device

The electric eye has been applied with success by the Ford Motor Co. in a number of interesting inspections. Fig. 6 shows one end of a highly ingenious machine developed to perform eleven inspec-

Fig. 5. Another Electric Heating Machine in which an Electric Eye Control is Employed to Shut off the Current when the Tip of Valve Stems has been Heated to the Desired Hardening Temperature

tions on valve push-rods. Forty push-rods are completely inspected per minute, which means a total of 440 inspections per minute.

On this machine, an electric eye is used in conjunction with a scleroscope to determine whether the valve push-rods are of the required hardness. As each piece reaches the scleroscope, the hammer of that instrument falls on top of the part. If the push-rod is sufficiently hard, the hammer will rebound high enough to intercept a beam of light that passes through the scale of the scleroscope to a photo-electric cell in back of the instrument. This permits the push-rod to pass to the next inspection station. However, when a piece is not hard enough to meet the requirements, the beam of light is not intercepted, because the hammer does not rebound sufficiently high. In that case, an electric relay operates a solenoid switch, actuating a finger that ejects the push-rod into a drawer at the front of the machine.

In this installation, the beam of light is only 1/16 inch wide by from 0.002 to 0.003 inch thick. If a larger light beam were used, the 1/8-inch scleroscope hammer would not cause sufficient diminution of the light to actuate the photo-electric cell. The scleroscope hammer, however, totally eclipses the light beam whenever it bounds through it.

Checking the Flow of Gasoline through Carburetor Jets with the Electric Eye

Photo-electric cells are also used in the Ford plant for checking carburetor jets to determine the rate at which gasoline can be forced through them in service. The jets are fed from the hopper of an inspection machine and clamped in a stationary position while benzol is forced through them. A small float moves up and down in a vertical glass tube to certain positions depending upon the size of the jet hole and, therefore, upon the rate of benzol flow through it.

If the hole through the jet is of such a diameter that from 52 to 56 cubic centimeters of benzol can be forced through per minute under a head of 50 centimeters, the float will remain between two beams of light that pass horizontally between light sources and electric eyes. The clamps of the inspection machine are then automatically released, and the carburetor jet rolls down a chute into a box provided for the jets that pass inspection.

However, if the hole through the jet is too small, permitting the float to fall too low in the tube, the beam of light to one of the photo-electric cells will be intercepted and a solenoid switch energized to swivel the discharge chute into line with a second box. Then, when the work clamps are automatically released, the jet rolls into this box.

Similarly, if the hole through the jet is too large, the upper light beam will be broken and the discharge chute swiveled into line with a third box, into which the jet will roll when released.

The hole through these carburetor jets has a nominal diameter of 0.050 inch, and the inspection machine is so devised that an error in the diameter is magnified about ten thousand times. The machine therefore insures quick detection of jets that do not meet inspection requirements. About 350 jets are inspected an hour, the machine being completely operated by hydraulic means.

In the Ford Spectrographic Laboratory, described in April MACHINERY, page 543, an electric eye is employed to control the movements of a galvanometer for reading spectrum photographs in connection with a microphotometer.

The applications of photo-electric cells described in this article should suggest other uses of this device in controlling machinery and safeguarding employes and tools.

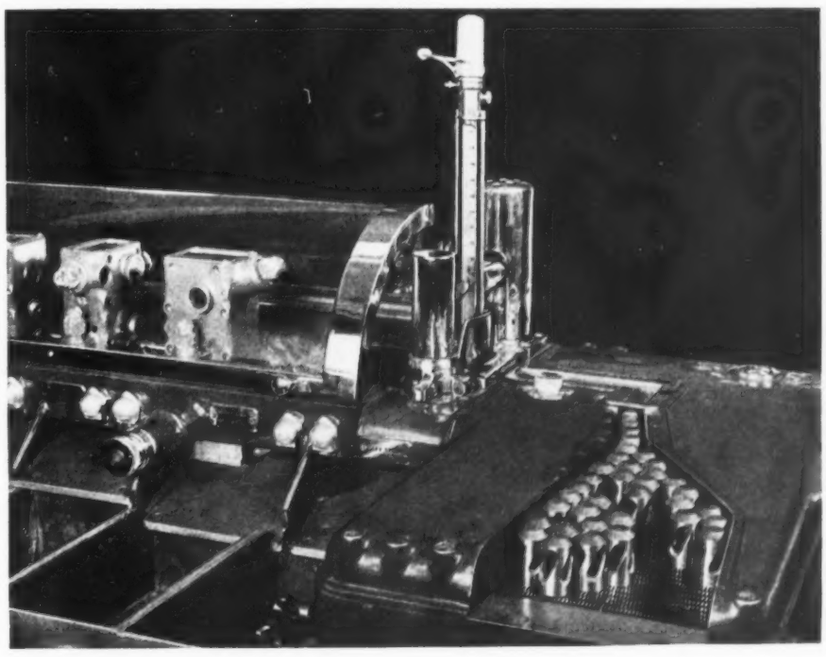


Fig. 6. Valve Push-rod Inspection Machine on which an Electric Eye Functions to Reject Push-rods that are not Sufficiently Hard, as Determined by the Automatic Operation of a Scleroscope

Choice of Materials—An Important Factor in Machine Design

In This Article, a Domestic Stoker is Used as an Excellent Example of How a Variety of Materials are Selected to Reduce Costs which, at the Same Time, Improve the Appearance and Increase the Usefulness of the Apparatus

By E. K. VAUGHAN
New Jersey Zinc Co., New York City

DURING recent years, one of the important problems facing the machine designer has been the choice of the proper material to use for various parts of a machine or device. Years ago, this problem was comparatively simple because there were so few materials from which to choose. Forged and bar steel and cast iron constituted almost the only materials, except in a few instances where brass and bronze were used.

Today the conditions are very different. In the steel group alone, where formerly the designer thought mainly of machine steel and tool steel, he now has to consider a score of different types of steels, alloy steels being substituted for the simple machinery steels of the past in many instances. Nor is steel used simply in forgings and bar form. Tremendous quantities of light and heavy stampings now constitute an important proportion of the materials of machine design. Plates and shapes have also become important factors, due to the development of the welding processes. The term "cast iron," too, has a broader meaning than in the past, for there are cast irons all the way from the ordinary gray iron castings to the highly specialized alloy-iron high-strength castings.

It is, however, in the non-ferrous fields that the most revolutionary changes in materials have taken place. Zinc and aluminum, to mention only two of the non-ferrous metals that are now used in the form of alloys for innumerable parts in machine design, have become so important as to completely replace the older metals in many instances.

Fig. 1. Fairbanks-Morse Domestic Stoker and Bituminous Coal Burner in Assembled Form, Showing the Pleasing Appearance Produced by the Pressed-steel Housing which Encloses the Operating Mechanism

Fig. 2. Gear-reduction Assembly, where Three Materials are Used—Zinc Die-casting for the Housing, Steel for the Worm and Shaft, Bronze for the Worm-gear, and a Zinc Die-casting for the Driving Sheave

The Engineer of Today Must Know Materials, as well as Mechanisms

An excellent example of the choice of different types of materials to serve various purposes in a modern design is furnished by the automatic burner or stoker for bituminous coal developed by Fairbanks, Morse & Co. In its simplest form, this stoker includes a hopper for feeding coal by gravity to a motor-driven screw conveyor, which carries the coal into the burner or furnace; a sirocco type blower on the motor-shaft for supplying air for combustion; a reduction gear drive for the conveyor; suitable housings and ducts; and control units for starting and stopping the screw conveyor and regulating the air supply.

The selection of the most suitable materials for the various parts of this stoker has an important effect upon its cost in quantity manufacture. For example, the main housing is produced at remarkably low cost, although heavy and expensive dies are required to make its side members from heavy stampings. These stampings and other parts which go to make up the housing, forming a part of the hopper, as well as an enclosure for the driving mechanism and fan, are of simple form and help to give the apparatus an attractive appearance.

When and Where Zinc Die-Castings are Used

The appearance is also enhanced by the hardware used, including hinges and latch handle, which are plated die-castings made from a corrosion-resistant zinc alloy. Die-castings made from this material were chosen because they are tough and strong, and can be produced by a process noted for its economy. Smooth surfaces and accurate dimensions are obtained without machining; hence low cost is coupled with good appearance.

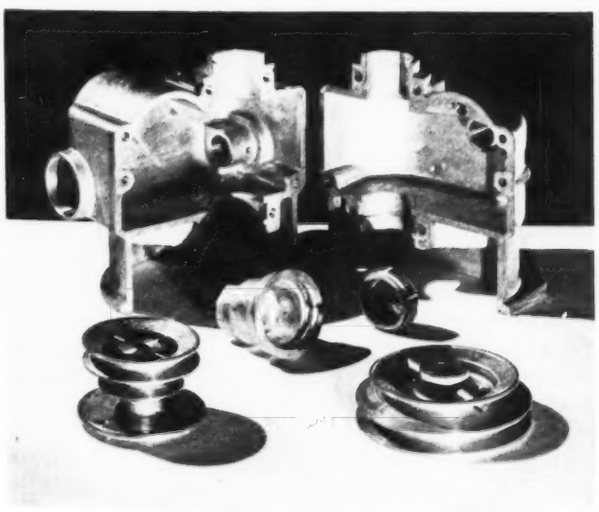


Fig. 3. Some of the Die-castings which Contribute to Economy in Manufacturing Costs and Simplicity in Manufacture. They Include the Two Halves of the Gear-case, Shear-pin Cover, and V-belt Sheaves

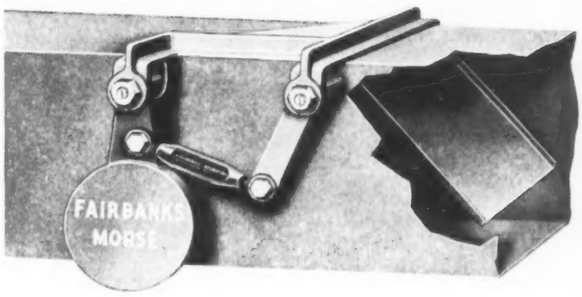


Fig. 4. The Firetrol Regulating Device Mounted on the Sheet-iron Duct. The Parts of This Mechanism are Made Mainly from Simple and Inexpensive Iron Castings Requiring Little or No Machining

The economy of zinc alloy die-castings is also one of the reasons for their use for other parts, as, for example, in the housings for the double-reduction worm-gear through which the conveyor carrying coal from the hopper to the burner is driven, and in the double-grooved sheaves which transmit power from the motor by V-belt to the reducing gear. It is a significant fact, often overlooked, that zinc alloy die-castings are stronger than ordinary gray iron and can be produced with sections thinner than feasible in cast iron. Another important factor is the saving in machining which, in the die-castings mentioned, is confined to simple reaming and spot-facing. In these operations, the amount of metal removed is negligible. Sand castings would have required a considerable allowance for machining, and therefore would have required roughing and finishing cuts.

In the present instance, the use of die-castings effected a saving of about 40 per cent in the cost of the finished housing. The sand castings used for similar purposes in an earlier design actually cost as much in the unfinished form, as received from the foundry, as the die-castings, fully machined ready for use. Moreover, the die-castings have a smoother surface and a better appearance, are corrosion-resistant, and do not have sand inclusions which, with sand castings, would require an extra operation for cleaning, and which even then might remain in the surface to the detriment of mating parts.

As indicated in Fig. 3, recesses are provided in the die-castings for ball bearings and bushings in which the high-speed shafts of the gear-reduction unit turn. There is also a recess for a ball bearing which takes both thrust and radial load on the drive-shaft to which the conveyor worm is coupled. The other bearing on this shaft, which turns at about 1 R.P.M., is directly in the castings, which are split in the plane of the axis of this shaft and are doweled to insure accurate mating. The castings provide a tight housing which holds and retains an ample supply of lubricant for gears and bearings. This unit, which is the heart of the stoker, is reported highly satisfactory in service and is said to require practically no attention.

The Importance of the "Shear Pin" which is Made from Steel

The final drive-shaft of the gear reducer drives through a steel shear pin, fitting into a collar having a square central hole mating with a squared shaft, which, in turn, drives the conveyor worm. This pin, which is easily replaced if sheared, is proportioned to shear under a torque of 2000 inch-pounds, which is from four to five times that required to drive the worm. The pin prevents injury to the driving unit if the conveyor worm should become locked through a piece of scrap steel or similar matter in the coal. A compartment termed a "spike catcher" is provided at the junction of the conveyor tube and hopper base, and has a "shear plate" which can be taken off to remove any obstruction which causes shearing of the shear pin.

The agitator wheel in the coal hopper meshes with and is driven by the screw conveyor, preventing coal from packing in the conveyor screw and from channeling or arching in the hopper. This wheel is made from cast iron and is thus relatively low in cost.

Aluminum, Steel Stampings, and Iron Castings Also Have their Place in This Design

Aluminum is another material that finds a place in this design. On the end of the motor shaft is mounted the blower wheel, which is an aluminum sand casting, selected because it is light in weight and relatively low in cost. A die-cast wheel was considered for this application and may yet be adopted, as it would lower the cost. Similar wheels are now being die-cast successfully.

Around the blower wheel is a stamped steel housing, again selected because of economy in manufacture and because it provides a smooth channel for the air flow. The blower discharges through galvanized steel piping which conducts air into the outer chamber of the cast-iron retort.

In the pipe is a regulating device termed a Firetrol," which is an automatic damper regulator. The parts of this device are mostly simple and inexpensive iron castings which require only the simplest of machining operations. The elbow-shaped retort into which the coal is delivered by the conveyor is made from cast iron, while the duct through which ashes or cinders are removed and the air duct are made from galvanized sheet steel. The elbow-shaped retort and the tuyere parts mounted above it are made from simple iron castings which require little or no machining, and are, therefore, quite inexpensive, as are also all the remaining parts of the assembly not mentioned.

Since all the parts entering into the assembled unit are required in large quantities, first-class tooling to produce them at minimum cost is warranted.

A consideration of design in which the materials used play a part to some extent, is the quietness attained in this unit, first, by using a motor designed and built for silent operation; second, by the use of worm-gears running in oil; third, by using a silent V-belt drive; fourth, by using a quietly operating blower; and, fifth, by enclosing all mechanical parts in a housing which does not transmit the slight noise developed in the interior of the mechanism to the outside.

As will be noted, practically all the more common materials of construction used in machine design have been employed in the construction of this stoker. It, therefore, furnishes a good example of the choice of materials to meet the physical requirements of the device and to assure low cost in conjunction with a pleasing appearance.

* * *

Jobs Do Not Just Happen

In a new book by C. Donald Dallas, president of Revere Copper and Brass, Inc., entitled "You and Your Money," the author points out how industry provides employment through the enterprise and courage of a few individuals. Without the spirit of enterprise, there would be no industrial employment.

First, someone must have an idea that he can produce an article that the public will want, and that he can produce it at a price that the public is willing to pay. Then he must have the courage, ability, and resources to manufacture the article and to market it. To do this, requires capital in the form of land and buildings, machinery, and materials. Working capital is required to insure, first, the payment of weekly wages until the enterprise becomes a going concern, and, second, the payment of the bills for raw materials. The working capital must also provide for the payment of taxes and interest on borrowed money.

Then, if the venture is successful and if anything is left over, the stockholders who put up the money for the buildings, machinery, materials, etc., in the first place, may receive a return on their money; if they do, of course, they will have to pay Federal and state taxes on what they get.

* * *

Anti-Business Propaganda as Seen by a Union Official

Propaganda . . . designed to discredit all business and industry can result only in injuring labor, as well as industry. This harmful and destructive propaganda should, therefore, cease. American industry is now in a state of convalescence. It needs no severe nostrums. It needs the encouragement of common sense. It needs the joint effort of labor, of management, of capital, of consumers, of all citizens, and, above all else, that of the Government. After all, the Government depends upon agriculture, industry, and commerce—and so does labor—and vice versa.—*Matthew Woll, Vice-president, American Federation of Labor, in the Greenwich Time*

Facing Flywheel on Horizontal Boring Mill

By R. C. HEINMILLER

The set-up shown in the accompanying illustration for facing a large flywheel on a horizontal boring mill was used in changing an air compressor drive from a flat belt to a V-flat drive. The V-flat drive was to use V-belts with a grooved pulley or sheave on the motor shaft and a flat-faced pulley on the driven unit. This drive is economically installed, as it is only necessary to provide a sheave for the motor and a set of V-belts. The pulley on the air compressor could be used as it was, except that it had a crowned face which had to be machined flat to provide a satisfactory V-flat drive. To remove the crown presented the greatest problem, as no lathe in the shop was large enough to handle the flywheel, which was 48 inches in diameter and had a 10-inch face.

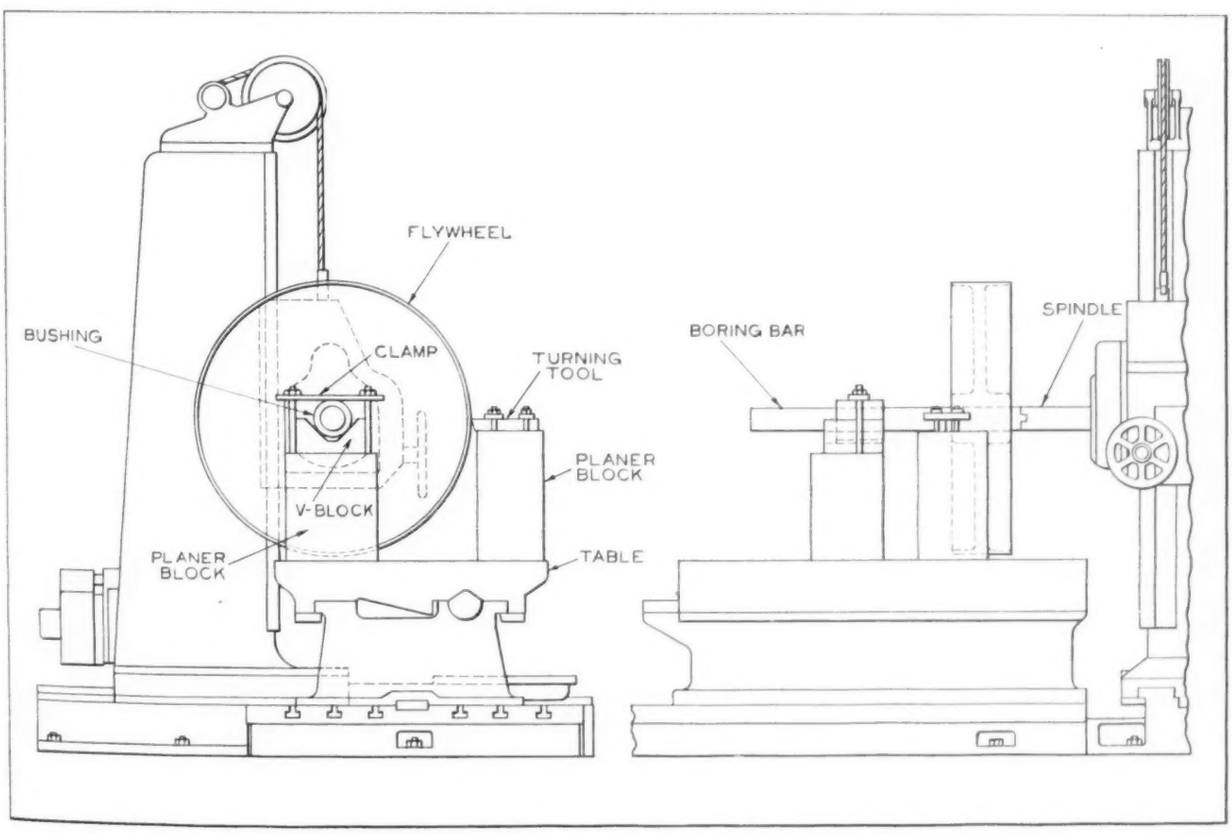
The change-over had to be made on a Saturday afternoon, and to send the pulley out to one of the local shops to be turned would have entailed considerable expense for trucking and over-time rates for the machine work. It was, therefore, decided to do the job on a horizontal floor type boring mill in the company's own plant. The flywheel was mounted on the heaviest boring-bar available, using suitable bushings and clamps. One end of the bar was supported in the machine spindle, and the other in a bushing clamped in a V-block and mounted on the planer blocks to obtain the proper height. In this way, the spindle could be fed in and out to move the face of the pulley past the tool.

The tool was mounted at the proper height on the table of the machine. After taking a cut, the tool was loosened and moved in a small amount for the next cut until the crown was removed and a flat face obtained on the flywheel. The drive described has been operating satisfactorily for over four years, proving that the unusual facing operation was successful.

* * *

Does the Cost of Advertising Increase the Cost of Goods?

In commenting on the question whether advertising increases the prices of advertised goods, the Bureau of Research and Education of the Advertising Federation of America calls attention to an interesting fact in connection with the prices of cameras. Ten years ago, a certain camera sold for $30. It was advertised extensively, sales increased, and overhead costs were reduced. Now, with larger production, the manufacturer is able to operate more economically and to sell a better camera for $15. The advertising cost amounts to 45 cents for each camera. The saving to the customer is $15. In a similar way, advertising has helped to lower prices in many other specific cases.



Flywheel Mounted on Boring-bar of Horizontal Boring Mill for Turning Face

Punch Press Die with Transfer Slide and Rotating Knurling Tool

By T. M. CURTIS
Curtis Engineering Design Co., Detroit, Mich.

A CAM-OPERATED transfer slide driven by miter gears from the crankshaft of the press, and a motor-driven knurling tool are, perhaps, the most unconventional features of the unusual punch press die shown in Figs. 1 and 2. This die was designed recently by the Curtis Engineering Design Co. and built by the Ligon Bros. Tool and Die Shop, Detroit, Mich., for a nationally known manufacturer.

The die is adaptable to any standard type punch

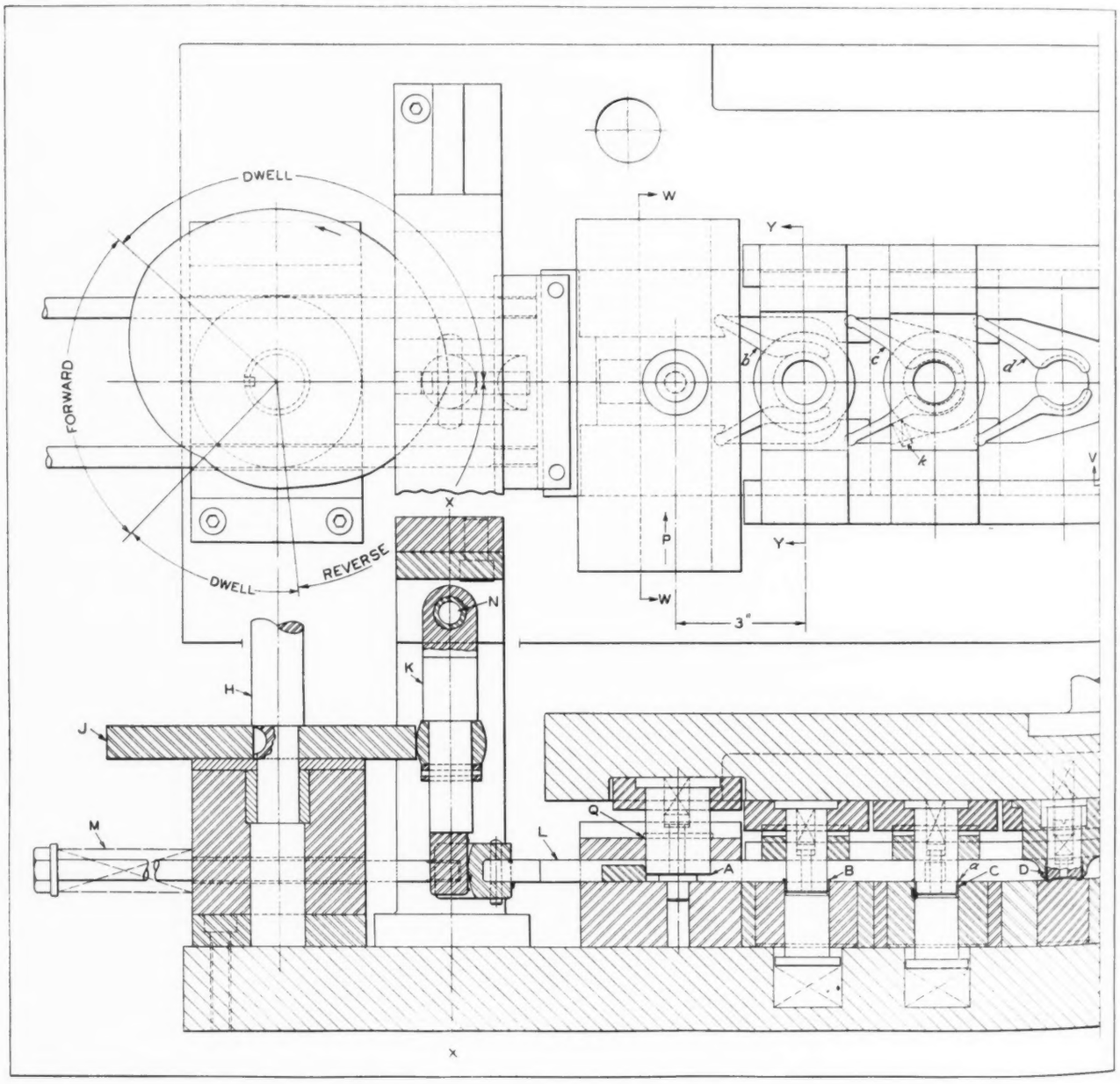


Fig. 1. Transfer-slide Operating Mechanism, and Blanking, Drawing, Trimming, and Forming Stations of Die for Producing Tooth-powder Box Cap

press, and is capable of producing from 5000 to 6000 caps an hour like the one shown at *G*, Fig. 3. The piece *G* is made from strip metal stock, 0.015 inch thick. The seven successive steps in the production of cap *G* from the blank *A* to the finished piece are illustrated in Fig. 3, the views at *C* showing the trimmed shell, with the ring or scrap *a* trimmed from it at the right. Although the cap is shown with a hole in it at *E*, the hole is not pierced until the succeeding step *F*, as described later.

The lower views in Figs. 1 and 2 show the die with the punch in the closed position, a cap being seen in the process of production at each of the seven successive stages. The same reference letters are used in Figs. 1 and 2 to identify each of the successive steps as are used in Fig. 3.

Referring to the construction of the die, shaft *H*, Fig. 1, is driven by the crankshaft of the press through a set of miter gears (not shown). With every revolution of the crankshaft there is a corresponding turn of shaft *H*. Keyed to shaft *H* is a cam *J* which actuates the lever arm *K*. Arm *K*, in turn, is connected to the transfer slide *L*, which carries six sets of fingers *b*, *c*, *d*, *e*, *f*, and *g* that move the part from one die station to the next.

The transfer fingers are normally pressed inward by means of springs, arranged as indicated at *k*, so that they obtain a firm grip on the work. The lever arm is moved forward by cam *J* and is returned and held firmly against the cam by pressure exerted by two springs *M*. In other words, the action of arm *K* is similar to that of a pendulum, with pin *N* serving as its fulcrum.

The stroke of the press is 3 inches, and the dis-

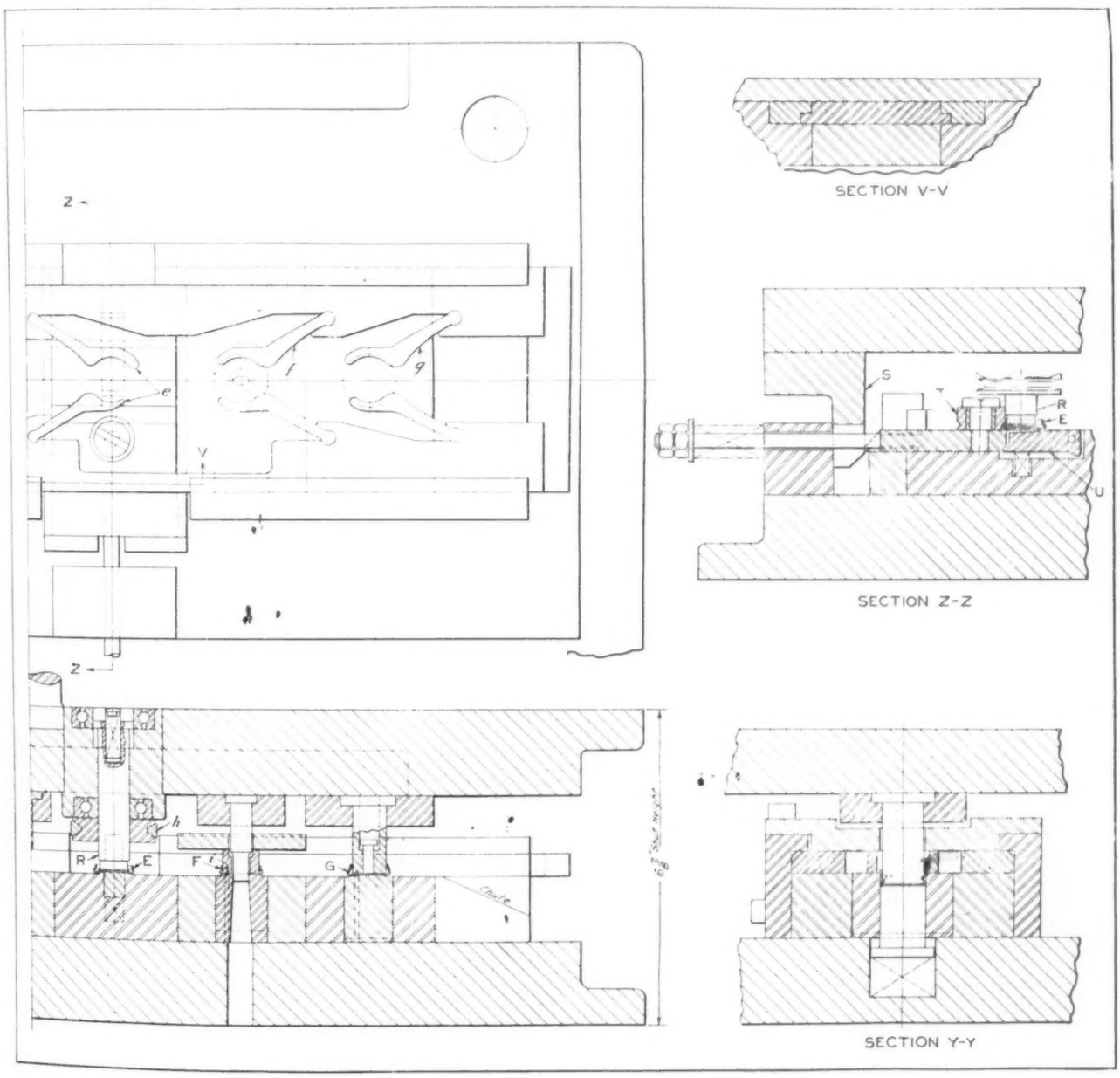


Fig. 2. Rotating Knurling Tool and Piercing and Stamping Stations of Die, the First Four Stations of which are Shown in Fig. 1

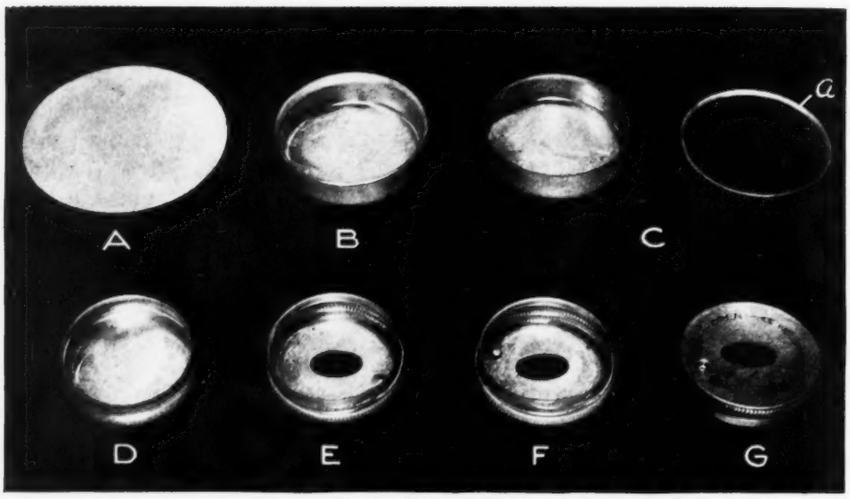


Fig. 3. Seven Steps in the Evolution of Tooth-powder Box Cap, as Produced by Dies Shown in Figs. 1 and 2

tance between successive die stations is also 3 inches. Assuming that the transfer slide is in the forward position, the timing is as follows: On the first 2 5/8 inches of the down stroke, the transfer slide is idle—see timing diagram, Fig. 4; on the last 3/8 inch of the down stroke, the transfer slide moves half way back, empty; on the first 3/8 inch of the up stroke, the transfer slide has a return movement until it reaches its starting position; the transfer slide remains idle for the next 1 1/8 inches of the up stroke; on the last 1 1/2 inches of the up stroke, the transfer slide moves forward for the full distance between stations with the work-carrying fingers loaded. The cycle is now completed, and a new part is located in each station.

The strip stock is fed by a "hitch feed" from the front of the die toward the rear in the direction indicated by arrow *P*, Fig. 1. At the first station, the blanking punch cuts out the blank at point *Q* and carries it down to the rest button at *A*. The scrap stock is cut off by the punch *O*, section *W–W*, Fig. 4. From this position, the first set of fingers *b* take the blank to the second station. Here the blank is drawn into a cup, as shown at *B*. From this station, the next set of fingers carry the part to the third die position, where it is trimmed, as at *C*. The flash shown at *a* is trimmed by the so-called "pinch trim" method, and is removed from the die by an air blast.

At the fourth station, two operations are performed—the sides of the cup are pulled or drawn in, as shown at *D*, preparing it for the knurling

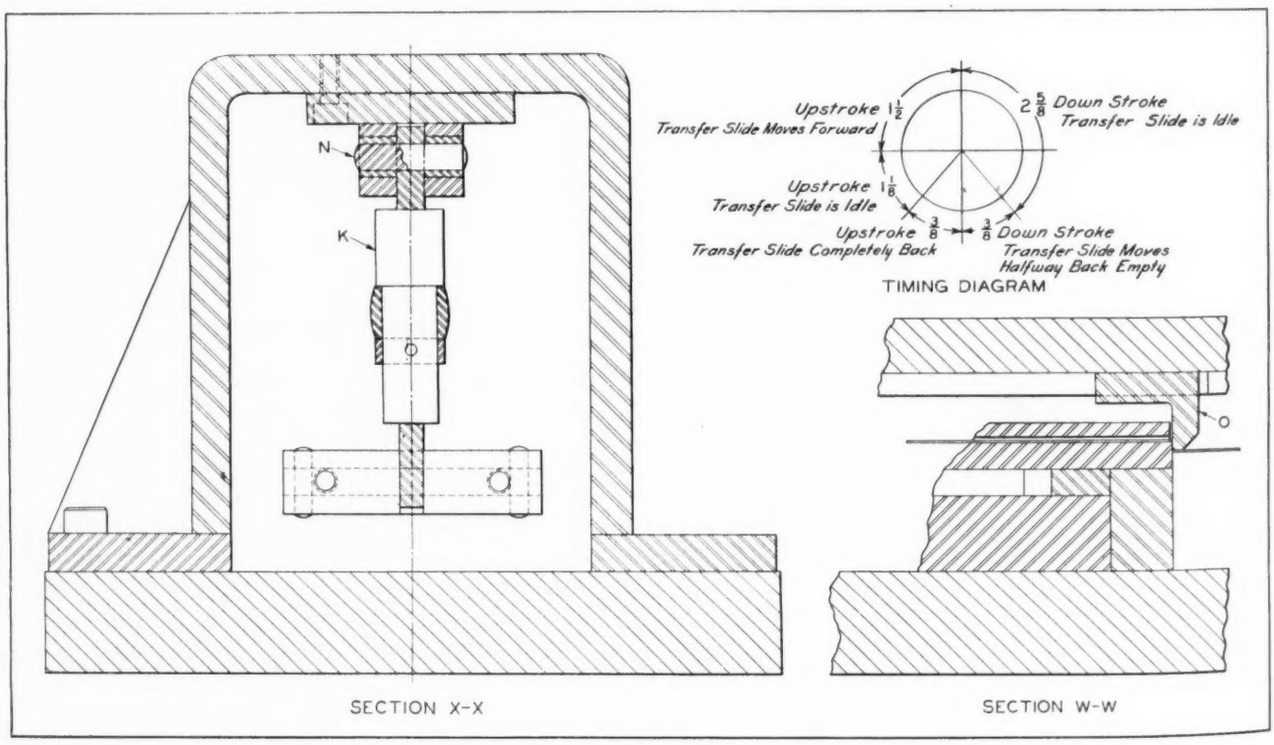


Fig. 4. Cross-section Views and Timing Diagram of Transfer Slide on Die Shown in Fig. 1

station, and the base of the cup is made concave, approximately 0.015 inch. The fifth or knurling station, shown in Fig. 2, is perhaps the most unusual part of the die. When the transfer-slide fingers *e* bring the part to this station, a floating shaft *R*, supported in a bushing between two thrust bearings, comes into the operating position. This shaft has a pulley secured to it, and is driven at a speed of 7800 R.P.M., through the belt *h*, by an independently mounted 1/2-H.P. motor located at the rear of the press.

As the knurled portion of shaft *R* enters the cup *E*, driver *S* (section *Z–Z*) presses into action a cam which carries the internal knurling tool *T*. At the same time that the cam presses cup *E* toward shaft *R*, the turning shaft spins the cup, rolling the collar of the cup to the required size and knurling the lower edge. The driving cam *S* dwells during a ram movement of only 1/8 inch, which allows the cup to spin for approximately 20 revolutions. In order to reduce friction on the lower surface of the cup during the spinning operation, a cam surface on the member carrying roll *T* pulls down the lever *U*, located directly below the spinning shaft.

At the sixth station, the elongated hole is pierced in cup *F* and a small round boss is formed at *i*. This small boss is restruck at the seventh station, and the words "open," "close," and "patented," as well as indicating arrows, are stamped on the top surface of the part.

An important point in the design of this die is the provision of a spring plunger within each punch, which holds the work in position after the transfer-slide fingers have left it until the punches begin their operations. Although the die illustrated is designed for concentric round parts, the transfer-slide principle can also be used for a variety of irregular-shaped parts. The transfer fingers were made by shaping a long bar of steel to the desired outline and then cutting off pieces of the required thickness. This procedure insured a uniformity of outline that would be difficult to obtain if the fingers were shaped individually.

* * *

Research on Industrial Lighting

Three valuable contributions to the subject of industrial lighting in the machinery industries have been reprinted from the Transactions of the Illuminating Engineering Society, 51 Madison Ave., New York City. These reports deal, respectively, with lighting for the machining of small metal parts; the lighting of power presses; and lighting for intricate production, assembly, and inspection processes. The reports contain a great deal of information of direct value to the shop executive who wishes to study the influence of good lighting on the output and accuracy of the product. Because of the widespread interest in industrial lighting and the great importance of this subject, the Illuminating Engineering Society has performed a distinct service to industry in publishing these reports.

A Few More Figures that Show How Machine Tools Increase Employment

In a recent address entitled "The Machine Tool Industry and What it Means to the World," August H. Tuechter, president of the Cincinnati Bickford Tool Co., Cincinnati, Ohio, stated that, while the machine tool industry alone does not employ more than about 50,000 workers, it is only through the use of machine tools that millions of workers can be employed in other industries. In fact, close to 500,000 workers are employed in automotive plants, and 6,000,000 workers all together derive their livelihood directly or indirectly from the activities of the automotive industries. Without machine tools, there could be no automobiles; without automobiles, there could not be industrial employment for all of these people.

Mr. Tuechter also mentioned that 25 per cent of all people gainfully employed in industry today owe their jobs to industries that depend upon such types of machine tools as have been developed since 1900. While stressing the necessity of devoting the facilities of industry to national defense, Mr. Tuechter emphasized the point that the main objective of the machine tool industry is the production of equipment dedicated to the arts of peace.

* * *

Hard-Faced Circular Saws for Cutting Wall Board

A company using circular saws for cutting wall board, after trying several ideas and materials to increase the saw life, decided that hard-faced saws were best suited for their particular type of work. The wall board was composed of shredded wood and magnesite cement, and was very abrasive. The conventional saws for cutting this board wore out rapidly. When the saw teeth were hard-faced, however, the life of the saw was increased eight to ten times.

The hard-facing operation is very simple. The saw teeth, spaced 5/8 inch apart, are first prepared by grinding recesses in them. No. 1 Haynes Stellite welding rod is then flowed on the prepared recesses by the oxy-acetylene process. For a 16-inch diameter saw, approximately 1/4 pound of hard-facing material is required; the welding operation takes two hours. When the hard-facing is completed, the teeth are ground to size and shape.

* * *

An encouraging indication of improved business conditions is furnished by the announcement of the General Electric Co. that, in the first quarter of 1939, the orders received by the company amounted to nearly $87,000,000, as compared with somewhat over $65,000,000 for the corresponding period in 1938, an increase of 33 per cent.

Types of Heat-Treating Equipment

A Review of the Different Types of Furnaces and Other Equipment Used in the Modern Heat-Treating Department
Second of Two Articles

By ROBERT C. DEALE, Consulting Engineer

IN the first installment of this article, published in April MACHINERY, the different types of furnaces used for heating steel for hardening and tempering were briefly reviewed. The present installment will deal mainly with the methods used for heating these furnaces and for controlling the temperature and atmosphere.

The three principal means of heating furnaces of the type referred to are gas, electricity, and oil. Gas, where it can be obtained at a reasonable commercial rate, provides a satisfactory means of heating. For combustion, it requires air under pressure, usually supplied by a small independent blower, and means for disposing of the burned gases. When used in a full-muffle furnace, there is no tendency to scour the tool surface. The furnace chamber is free from the combustion gases, and can be maintained at any desired atmospheric condition.

The furnace linings usually have to be replaced more frequently than in electric furnaces, since the temperature of the outside of the muffle in a gas-fired furnace must be several hundred degrees higher than that at which the heat-treatment is carried out, due to the reduction in temperature resulting from forcing the heat through the muffle walls. In electric furnaces, the heating units are usually in the same chamber as the tool being treated. On the other hand, in most localities gas provides a cheaper heat than electricity.

When gas is used for heating a direct-heat or semi-muffle furnace, the furnace atmosphere is made up of burned and partially burned gas. In that case, the desired atmosphere is obtained by controlling the combustion of the main burners through regulation of the proportions of gas and air. When the gas used is a hydrocarbon, an appreciable amount of water vapor will be produced in the furnace chamber by the combustion. The exact effect of water vapor on tool steel at high temperatures is not known, but such data as are available indicate that large percentages of water vapor are undesirable. In this type of furnace, it is difficult to maintain both the temperature and the atmosphere in the furnace chamber at a predetermined value with any degree of precision.

Electrically heated furnaces fall into two main classes, depending on the temperature to be maintained. When the required temperature is below 1800 degrees F., electricity is a very satisfactory type of heat, in spite of the fact that it is expensive in operating cost. Heating elements of the metallic resistor type are used, which are relatively inexpensive and have a satisfactory operating life. There are no fumes from the products of combustion, and consequently no flue or ventilating system is necessary. Air under pressure is not needed. The automatic controls for maintaining a constant furnace temperature and for starting and turning off the furnace at predetermined times without the attention of an operator are dependable.

When temperatures ranging from 2200 to 2500 degrees F. are required for hardening high-speed steel, metallic resistor elements such as are now available are not practicable, because they will not stand up under these temperatures. New developments in this direction may remedy the difficulty.

The electric furnaces now on the market for the hardening of high-speed steel are heated by silicon-carbide resistors, placed in the furnace chamber so that the tools are heated by radiation and are not protected by a muffle. They are usually placed on a hearth of silicon carbide, which is a good conductor of heat; the hearth is heated from beneath, so that the tools receive heat from all sides.

Oil is seldom used for heating furnaces used in hardening high-speed steel, mainly because of the small size of these furnaces.

Temperature Measurements and Control

Few shops understand the extreme importance of accurate temperature control in the hardening of tool steels. As a result, relatively few furnace installations provide adequately for the accurate measurement of furnace temperature or for maintaining it automatically at a predetermined point. It is not possible to harden tools regularly so as to obtain the maximum cutting efficiency unless the hardening temperature is accurately controlled.

For that purpose, the furnace must be provided with an accurate pyrometer and means must be available for checking it at frequent intervals. The pyrometer must be placed so as to measure, as nearly as possible, the temperature reached by the tool. The temperature of the furnace in which the tools are heated must be kept reasonably uniform; and, finally, the pyrometer must be used to control the temperature within narrow limits.

It is false economy to operate without a pyrometer. A close approach to maximum cutting efficiency of a tool cannot be secured without its use, while the danger of tool spoilage is greatly increased.

A pyrometer regularly used in production gradually deteriorates. A standard checking pyrometer should be provided, and used at frequent intervals to check the readings of the working pyrometer. This checking should be done at intervals of approximately fifty operating hours of the furnace.

While the uniformity of temperature within the furnace is dependent on the furnace design, the thermo-couple of the pyrometer should be so placed as to be subject, as nearly as possible, to the same heating conditions as the tools to be hardened, so that the pyrometer will register the temperature of the tool, irrespective of the temperature distribution in the furnace.

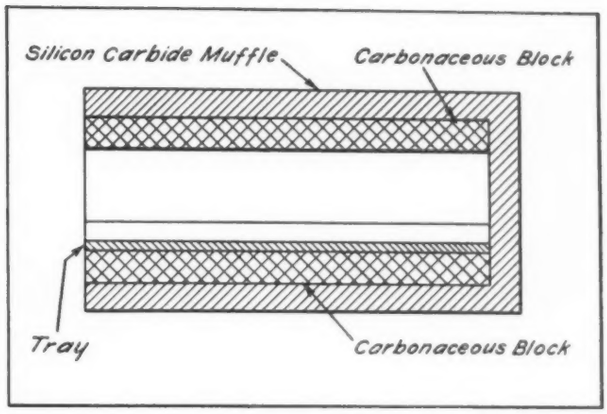
To protect the elements of the thermo-couple from contamination and oxidation by furnace gases, they are mounted in closed-end tubes of metal, porcelain, or other refractory and preferably gas-tight materials. The choice of a proper protection tube is as important as the selection of the thermo-couple. It is desirable to follow the instructions of the furnace or thermo-couple manufacturer closely, as to the method of mounting and protecting the thermo-couple.

When the number of tools requires a furnace to be operated more than five or ten hours a week, automatic temperature control is desirable. Such control will hold the furnace temperature automatically within 5 or 10 degrees F. It may be arranged to start the furnace before the shop opens in the morning, so that it will have reached the operating temperature when the men start work, thus making it possible to use the furnace for the entire working day. The automatic temperature control will hold the furnace at the proper hardening temperature without the necessity of full-time attention on the part of the operator.

When the quantity of tools to be hardened is so small that the purchase of an automatic control may not be economical, close watch should be kept of the pyrometer reading and adjustment of the gas and air inlets should be made whenever required to insure constant furnace temperature. Close manual control of this kind is satisfactory as a substitute for automatic control, provided the operator can devote his attention to the operation of a single furnace, but it is uneconomical when the furnace is in use a considerable part of the time.

Controlling the Furnace Atmosphere

While competent heat-treaters have long realized that the atmosphere in the furnace should be controlled so as to minimize the scaling of the tools, and have done what is possible to control it by regulating the mixture of gas and air, it is only within the last few years that the full importance of accurate atmospheric control has been understood and equipment made available for the purpose.



Carbonaceous Block in Muffle for Use in Hardening High-speed Steel

Furnaces are now built with controls that maintain the furnace atmosphere within 1 per cent of CO or CO_2, regardless of the temperature regulation. This is accomplished by the use of an oven type furnace, electrically heated, or a furnace of the full muffle type when gas or oil is used for heating, with a door as the only opening into the chamber in which the tools are heated. A gas jet the full width of this door is provided which operates with controlled gas and air pressure. These pressures are usually measured directly by a manometer mounted on the furnace. A calibration that determines the furnace atmosphere by analysis for given pressures of air and gas makes it possible to plot the furnace atmosphere in its relation to the gas and air pressures of the auxiliary burner. Usually the pressure of one is held constant to simplify the operation.

The furnace atmosphere can also be controlled through the introduction of a material that produces the desired condition. Some hardeners have been accustomed to throwing a wood block, a handful of waste, or the like, into the furnace to burn off the excess of oxygen. A small muffle made of heat-resisting material and lined with a carbonaceous material, as shown in the illustration, which may be used in any oven type furnace is available. This muffle accomplishes the purpose of atmosphere control in a more satisfactory manner. The tools are placed in the muffle on a nickel or silicon-carbide tray, and then heated, but the exact composition of the reducing atmosphere thus produced cannot be accurately controlled.

It has been found that the use of an atmosphere which is neutral to a given steel at the furnace temperature required makes it possible to harden a tool made from it without scaling or surface decarburization, and to hold the tool for longer periods at the hardening temperature without causing excessive grain growth. This is a highly important point, because there is evidence to the effect that tools should be held for much longer periods at the hardening temperature than is now the practice, in order that the full cutting efficiency of the steel may be obtained.

Engineering News Flashes

The World Over

The Navy Will Use X-Ray Equipment to Find Defects in Metals

The United States Navy expects to make use of X-rays in the New York and Philadelphia Navy Yards for finding possible defects in metals up to 3 inches thick, used in naval equipment. The new units will pick out flaws invisible to the naked eye and unsuspected on the surface of the material. The important feature of the new X-ray unit, which was built by the Westinghouse Long Island City Works, is that, although it weighs three-fourths of a ton, it can be loaded on board a ship and moved about very easily, since it is supported by wheels with balloon tires. The equipment is approximately 3 feet wide by 5 feet long over all.

Fans Have Made Billions of Revolutions and Are Still Running

On the roof of the laboratory building in the Pittsfield, Mass., Works of the General Electric Co., are three transformer fans which have been left there to run to destruction, for testing purposes. During more than nine years, day and night, summer and winter, with temperatures ranging from 40 degrees F. below zero to a sweltering heat of 115 degrees F., these fans have continued to run; and they will be run until worn out, "even if," as one of the engineers said, "it takes till doomsday and all the electricity in Massachusetts." Up to the present time, the armature of each motor has rotated more than 7,750,000,000 times, since it revolves at the rate of 1500 R.P.M. Further, since each set of fan blades has an output of 1600 cubic feet of air per minute, the fans have displaced up to the present time at least 580,000,000 pounds of air.

Tests on Passenger Steam Locomotives Point to New Developments

Actual road tests to determine the ultimate possibilities of present steam passenger locomotives have been conducted by the Association of American Railroads in a joint research project of the railroads and locomotive builders. A 1000-ton experimental train, consisting of a dynamometer car with sensitive recording instruments, a baggage car, and more than a dozen passenger cars, is being run between Fort Wayne and Valparaiso, Ind., a distance of approximately 115 miles. The instruments in the dynamometer car will record a great variety of technically important data relating to engine performance. The train was furnished by the Pennsylvania Railroad, and is operated under

(Left) A Skillful Operation in Motor Manufacture. Locking in the Wedges that Hold the Coils in Place in the Stator Frame of a Large Synchronous Motor

(Right) Another Important Operation in Motor Manufacture. Snugging Down the Coils in the Stator Frame of a Large Induction Motor in the Schenectady Plant of the General Electric Co.

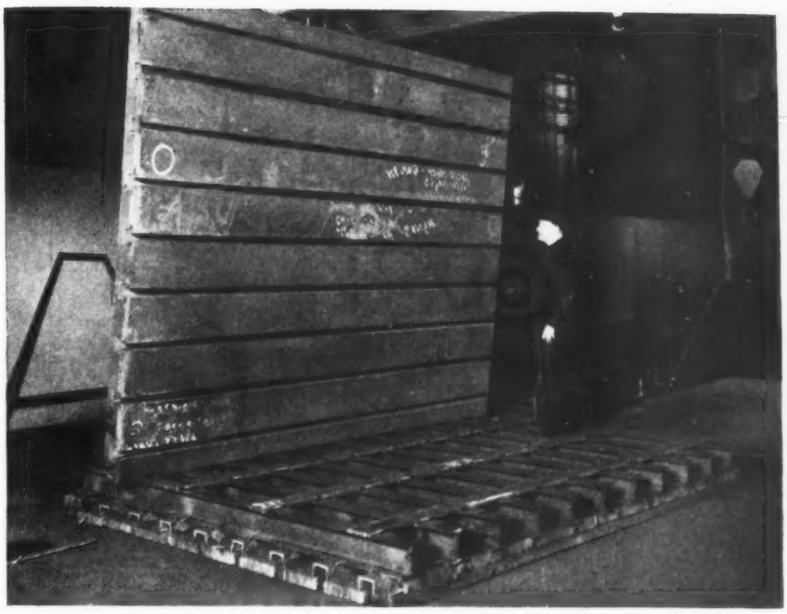


Illustration Showing Top and Bottom of Welded Steel Floor Plates Used by the Westinghouse Electric & Mfg. Co. for Testing Heavy Equipment. This is Part of 4100 Square Feet of Floor Plates that have been Strain Annealed and Machined on the Top Surface. A Saving of 25 Per Cent is Made in the Cost of These Floor Plates through the Use of Welded Fabrication

the supervision of a special committee of the mechanical division of the Association of American Railroads.

The research project of which these road tests are a part was begun in 1937 with the object of developing a reciprocating steam locomotive capable of handling trains of 1000 trailing tons at 100 miles an hour on level, tangent track. To accomplish this, it is believed that from 5000 to 5500 cylinder horsepower will be required.

A Miniature Submarine that is Powered by Batteries

Five regular Kathanode automobile batteries supplied the power for an unusual 1000-pound, one-man submarine which recently made a successful 38-mile under-water crossing of Lake Michigan. This submarine is only 11 feet long, 3 feet high, and approximately 2 feet wide. Its body is made of steel. It has a cruising speed of four miles an hour, and a top speed of nine miles. Its builder, a young garage mechanic, Barney Connett, installed the unique power plant, using one battery for a compressor, and two sets of two each alternately for power. Exactly what use this miniature submarine might have has not been stated.

World's Shipping Statistics Indicate Growth of Shipbuilding

According to statistics published by *Lloyd's Register*, the world's ocean-going tonnage of steamers and motor ships in June, 1914, amounted to 45,400,000 tons, representing 24,444 vessels. In June, 1938, this tonnage had expanded to 66,870,000 tons, representing 29,409 vessels. While, of recent years, oil engines are used in approximately two-thirds of the *new* vessels being built, it is of interest to note that reciprocating steam engines still propel a ship tonnage of 42,200,000—very nearly two-thirds of the world's tonnage—leaving the remainder for turbine-driven and oil-engine driven ships. Of the tonnage today, 26.4 per cent is registered in Great Britain and Ireland; 13.4 per cent in the United States; 7.5 per cent in Japan; 6.9 per cent in Norway; 6.3 per cent in Germany; 4.9 per cent in Italy; 4.3 per cent in France; and 4.3 per cent in Holland.

A Telephone Instrument that Requires No Outside Electric Current

A new telephone instrument that obtains its power solely from the speaker's voice and enables the user to call any of five other stations has been developed by the Western Electric Co. Designed primarily for use on shipboard, the new device is said to be highly reliable. Failure of the ship's electrical supply system will not affect the operation of this telephone, because its electrical voice current is generated internally by the impact of sound waves on a diaphragm, and, hence, is independent of an external power circuit. A self-contained hand-operated generator provides for signaling the different stations.

As many as six instruments can be connected in a network. Calls can be made between any two of these telephones, or "conferences" can be held over the entire system. Although the device was designed primarily for marine use, its water-tight, weather-resistant construction adapts it ideally for service in construction camps, factories, and similar locations. The new instrument, which is known as the "11A magnetic telephone," is intended for communication only at close range, but the measure of its effectiveness can be gained from the fact that in a test, transmission was obtained over a line of No. 9 copper wire 200 miles in length.

EDITORIAL COMMENT

In the field of economics, some of our political leaders seem to believe that they have discovered perpetual motion. When things do not go right, when business drops off and purchasing power vanishes, they believe that they can re-establish normal conditions simply by borrowing more money, spending it without receiving any equivalent return, and placing more and more people on relief.

Many Still Believe Perpetual Motion Will Work

There is one class of men in industry, however, who know that perpetual motion will not work. They are our engineers and mechanics. They cannot be fooled. They know that there is no such thing as getting something for nothing. They know that if you want to set a machine in motion and keep it running, you have to provide real motive power—not mere sleight-of-hand tricks. They know that you cannot drive a motor by electric current borrowed from the future; if the motor is to run, the generator must first have produced the current. And before the generator will run, it must obtain its driving power from a turbine or other power source.

But in the field of political economics, such matter-of-fact things are overlooked. A perpetual-motion machine has been devised, deficits are piled up annually, the national debt is increased, and we are asked to believe that this is sound doctrine.

A great deal of misinformation is current on the attitude of industry toward workers over forty years of age. Many men prominent in political and labor circles have given currency to the idea that men over forty are not wanted in industry. It is, therefore, of both interest and importance to be able to place on record a sufficient number of facts on this subject to make it possible to form a definite conclusion as to what is true and what is false in the current conceptions of industry's attitude toward men of this age.

Industry Has Begun to Combat Current Misinformation

The National Association of Manufacturers has made a survey and has compiled statistics based on 2485 replies to its questionnaires obtained from plants employing a total of over 2,334,000 workers.

The facts determined by this survey show that, contrary to general opinion, there has been no decline in the proportion of industrial employment of men and women over forty, compared with previous surveys made in 1923 and 1928. Furthermore, the survey shows that older workers are highly regarded in industry, and that those over forty constitute an important part of the working forces, the skill and the greater loyalty of the older men being greatly valued in industrial plants.

Among the important points brought out by the survey, the following may be mentioned: When layoffs were made in 1937 and 1938, preferential treatment was generally given to workers forty years old and over. Not a single company discharges workers when they reach the age of forty. No maximum hiring age limit is maintained by close to 90 per cent of the companies included in the survey; only 7.5 per cent of the number had age limits. In hiring workers, however, 38 per cent of the companies stated that they gave preference to men below forty, principally because of training and apprenticeship requirements, and because of the physical strength and endurance required for certain work.

Some Facts about the Man Over Forty in Industry

A substantial portion of the employes hired in 1938 were forty years of age or over, and there was a larger percentage of employes of this age in 1938 than in 1937. Over 50 per cent of the firms stated that they considered the cooperation and loyalty of employes over forty greater than that shown by younger men.

In 1937, the proportion of workers between forty and fifty years of age was over 20 per cent of the total employed. The age group between fifty and sixty represented nearly 10 per cent of the total employment. In other words, of all the industrial workers, considerably more than 30 per cent were over forty years of age.

It is of great interest to note that industry has begun to assemble and publish definite facts on many subjects concerning which agitators, politicians, and others with an axe to grind formerly were able to make unsubstantiated statements without contradiction, because statistics giving the real facts were not available. So many of these generally believed statements with regard to industry have been found to be erroneous when the real facts have been recorded.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Compound Cam Mechanism

A mechanism employed on a French net-making machine that embodies an interesting application of a compound cam movement is shown in Fig. 1. The object of the mechanism is to give to the needle point n, Fig. 1, a closed path of the form shown in Fig. 2, and additionally, an endwise movement normal to the plane of the paper. To effect this, there are two large gears, A_1 and A_2, meshing together, each of which carries a cam. In the case of gear A_1, the cam is formed as a closed track by attaching to the wheel the inner and outer members a_1, and in the case of gear A_2 by providing a rim a_2. A lever B_1 is slotted at b_1 so as to embrace the shaft 1, and is provided with a slipper block (not shown) for this purpose. At its upper end this lever carries a roller c_1, fitting the cam track previously described. A second lever B_2 is slotted or forked at b_2 to embrace the shaft 2, being provided with a slipper block as shown. A roller c_2 is employed to engage the cam a_2, being kept in contact with it by means of a strong spring, not shown.

At C levers B_1 and B_2 are connected by a pin, so as to have a free turning movement. As shown, lever B_2 is continued to the left of C and carries a needle bar N.

So far, then, it will be seen that if gear A_1 were held stationary and A_2 were turned (not practically possible, of course), then the cam a_2 would give to the needle a substantially horizontal to and fro motion. Similarly, if we imagine gear A_2 held and A_1 turned, then the needle would receive a substantially vertical reciprocatory motion. Therefore, when both wheels are rotating, being driven by pinion P, a combination of these movements is effected, giving rise to an enclosed locus, as shown in Fig. 2.

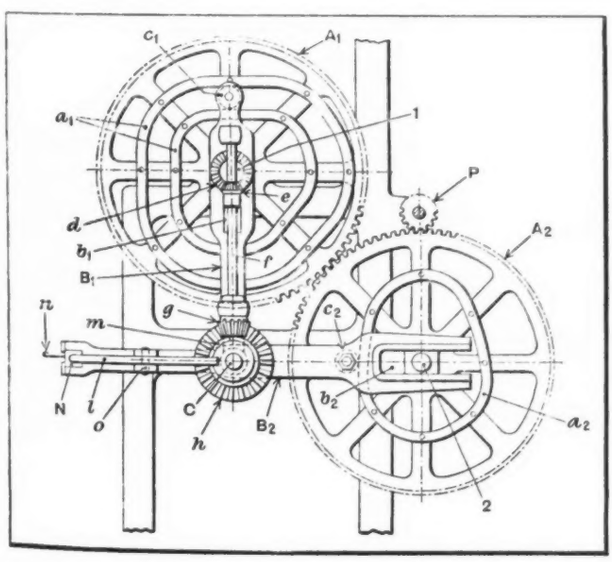


Fig. 1. Compound Cam Mechanism Employed on a Net-making Machine

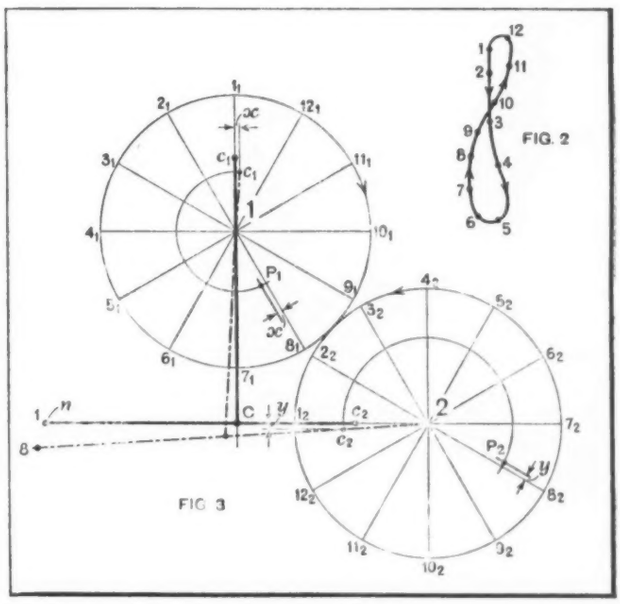


Fig. 2. Path of Needle Point Controlled by Mechanism Shown in Fig. 1. Fig. 3. Method of Determining Cam Profiles

It is instructive to consider the method of finding the cam profiles for a given locus. When the needle point n is at position 1 of the locus, the levers are at right angles, as shown by heavy lines in Fig. 3. First, it is necessary to mark off on the locus, positions which will be occupied at successively equal time intervals, this being done from a knowledge of the required rapidity of movement between each such position. Such a series of points is shown as 1 to 12, Fig. 2. Next, circles are described on centers 1 and 2, Fig. 3, and are divided into twelve parts, as shown; the commencing position being noted, also the direction of numbering, thereon.

Consider a point such as 8. It is obvious that the center lines of the levers B_1 and B_2 must always pass through centers 1 and 2, respectively, and their lengths being fixed, it is a simple matter to determine the lever positions, and therefore the roller centers c_1 and c_2. Now, for this disposition of the

linkage, the cam wheels will have turned through an angle such that division lines 8_1 and 8_2 will be at the positions first occupied by division lines 1_1 and 1_2, respectively, as shown in the diagram. The offsets x and y must also be noted. Now transfer the positions of points c_1, c_2 around to divisions 8_1, 8_2, respectively, and thereby locate points P_1 and P_2, which will be points on the required cams. Repeating this process for the other positions of the levers, will enable the whole of the cam profiles to be determined.

A further motion is incorporated in this mechanism, and this serves to move the needle point sidewise, transversely to the plane of the gears in Fig. 1. This is accomplished as follows, and during the time the points are moving from 2 to 3 in the locus diagram.

Attached to shaft 1 so as to rotate with it is a bevel gear *d*, and meshing with this is a bevel pinion *e*, keyed to shaft *f* which is carried in bearings on lever B_1. At the lower end of this lever is another pinion *g*, and at the junction *C* of the levers is a bevel gear *h* driven from pinion *g*, gear *h* carrying a face cam *m*. A boss is formed on lever B_2, and a transverse pin *o* in the boss provides an axle for a lever *l*, one end of which is engaged by cam *m*, the other end coming in contact with the end of the needle-point bar at *N*.

Thus, as the mechanism turns, the bevel gear train causes rotation of the face cam *m*, and accordingly produces the endwise movement desired.

The whole mechanism provides an unusual example of the compounding of movements, and is suggestive of other applications where complex paths have to be traced out by a moving element.

L. H. L.

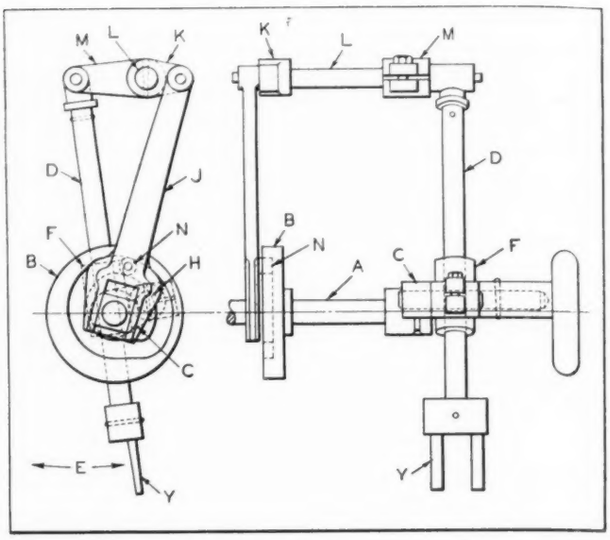
Feeding Mechanism Operated by Crank and Cam

By F. SERVER

A very smooth oscillating movement is imparted to the fingers *Y* of the mechanism shown in the illustration by means of a crank *C* and the cam *B* secured to the rotating shaft *A*. The oscillating movement is approximately as shown by the arrow *E*.

Arm *D* is free to slide up and down in a connecting block *F*, which is pivoted to the stud *H*. Stud *H* forms a part of the lever *C*. As shaft *A* revolves, it carries block *F* to the left or right and up and down through the medium of the connecting stud *H*. However, we are only concerned with the movement to the left and right, as the block merely slides up and down on the arm *D*, accomplishing no work while sliding vertically.

While the oscillating movement is taking place, the cam fork *J* moves up and down, being actuated by the roll *N* which is attached to it and travels in the groove of cam *B*. This causes lever *K* to rock the shaft *L*, thereby causing lever *M* to move arm *D* up and down. The combined up and down movement of arm *D* and left and right movement imparted by the eccentric throw of lever *C* results in a very smooth oscillating movement of the fingers *Y*.



Mechanism for Imparting Smooth Oscillating Movement to Fingers Y from Rotating Shaft A

Automatic Work-Locating Mechanism for Milling Machine

By L. KASPER

A large number of pieces such as shown in Fig. 1 are end-milled as indicated at *M* after the groove *N* is milled. The operation is performed on a vertical hand miller by setting the cutter to the proper depth and sliding the work into a clamping fixture, the central groove permitting the end-mill to enter, as indicated in Fig. 2. The work-table is then moved to the right and left for cutting, and returned to the central position for removing the work.

As the central groove is but slightly wider than the diameter of the end-mill, it is necessary to stop the table in the position for loading and unloading with a fair degree of accuracy. Figs. 3, 4, and 5 show the construction of an attachment that locks the table positively in the loading position and permits the required amount of travel for cutting.

Referring to Fig. 3, the bar *C* is fastened to the machine table *B*, and carries the sliding block *D*, which is drawn to the left by the spring *S*. Bar *C* is notched in the center, as shown more clearly in Fig. 4. Block *G* is fastened to the knee of the machine and carries the sliding key *E*, which is actuated by the lever *F*. The block *D* is reduced in width at the left-hand end. The travel of the table *B* is limited by the usual stops, not shown.

Referring to Fig. 4, which is the starting point of the cycle, the table *B* is locked by the key *E* being located in the notch in bar *C*. After the work

fixture has been loaded, the lever *F* is depressed, withdrawing key *E* from the notch in bar *C* and permitting block *D* to be drawn to the left by the spring. When the lever *F* is released, key *E* comes to rest on the step on the end of block *D*, as shown in Fig. 3. The table *B* is then moved to the left, the block *D* being restrained from movement by key *E*.

When the travel to the left has been completed, and the table *B* is moved to the right, block *D* is permitted to slide toward its original position until the end of the slot comes in contact with the stud *H*. Continued movement of table *B* causes block *D* to be withdrawn from the end of key *E*, which then slides onto the solid portion of the bar *C*, the key *E* having been carried over and to the right of the notch by the block *D*. When table *B* reaches the end of its right-hand travel, it is returned to its central position, the key *E* resting against the end of block *D* and sliding on bar *C* until it reaches the notch in bar *C*. Key *E* then enters the notch in bar *C*, again locking the table in the loading position. Fig. 5 is a bottom view of Fig. 4, and Fig. 2 shows the attachment in position on the machine.

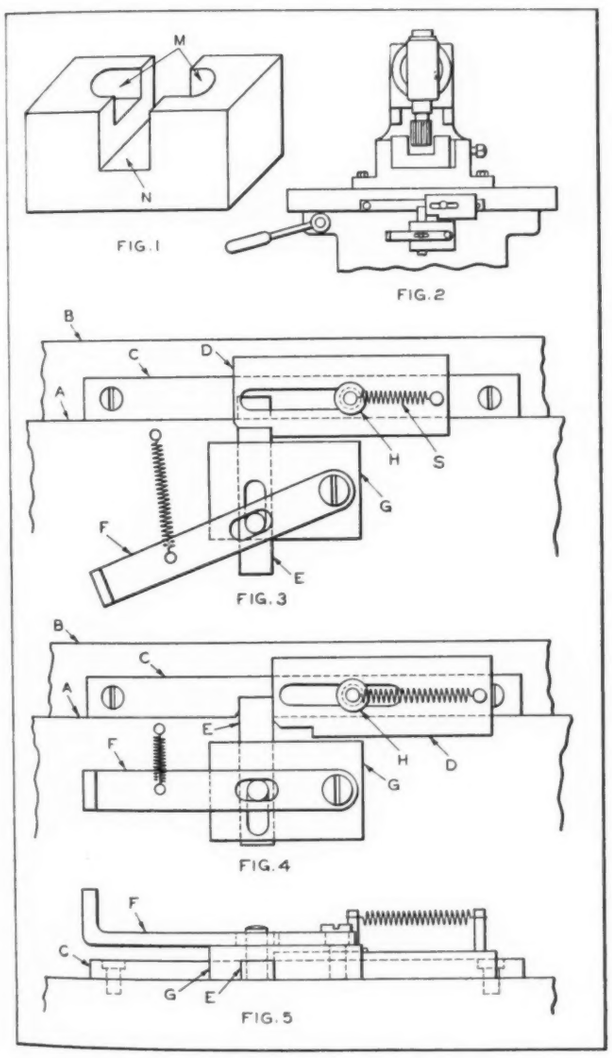


Fig. 1. Work End-milled as Indicated at M. Fig. 2. Milling Machine with Fixture and Locating Attachment. Fig. 3. Work Locating Attachment with Block D Drawn to Left by Spring S. Fig. 4. Locating Attachment at Starting Point of Cycle. Fig. 5. Bottom View of Attachment Shown in Fig. 4

* * *

The Whole Story

By M. JACKER

At the bottom of page 414, February MACHINERY, reference was made to what the automobile and the high-production machine have done to provide employment and wages. The writer would like to add that both the automobile and the high-production machine have been made possible by man's genius —by those who design and build the machines— and most important of all, by the large number of people that can be counted upon to buy the products of these machines.

If we had only a few million people living in this country, instead of more than one hundred and thirty million, it would not pay to build automobiles comparable with what we now have; nor would it pay to provide the wonderfully designed automatic machine tools and equipment that we have. Therefore, it is highly important that our economic system should function properly, so that all of our people will be in a position to buy at least second-hand automobiles, as well as all of the conveniences for the home that have been so highly developed during recent years.

* * *

Expansion Due to Temperature Creates Problems for the Designer

How important it is to consider thermal expansion in machine design where high temperatures are encountered is emphasized by the fact that a turbo-generator shaft 25 feet long may be 1/4 inch longer at operating temperature than it is at room temperature. Obviously, such an elongation is very serious unless the designer of the machine anticipates it and makes provision for it, so as to prevent damage. The modern trend in steam power machinery is toward higher operating temperatures. Hence the designer of today must be even more conscious of the thermal characteristics of materials and machine parts than was formerly necessary.

The copper in the generator winding expands even more than the shaft, but the insulation expands very little of its own accord, and hence is subjected to a severe pull. In motor design, consideration of such expansion becomes particularly important. The air gap in a small motor is not very large, so that very little thermal expansion may cause the rotor to scrape against the stator.

Examples of Copper Brazing

By P. E. HENNINGER, Manufacturing Engineer
Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

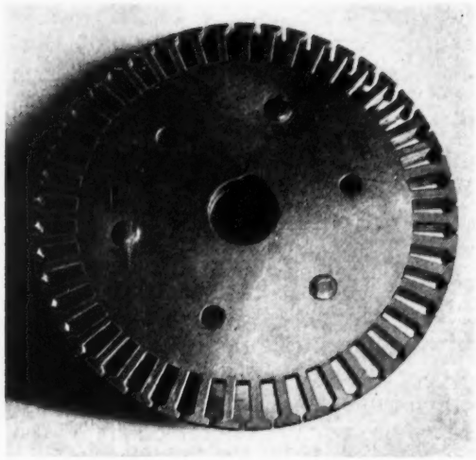
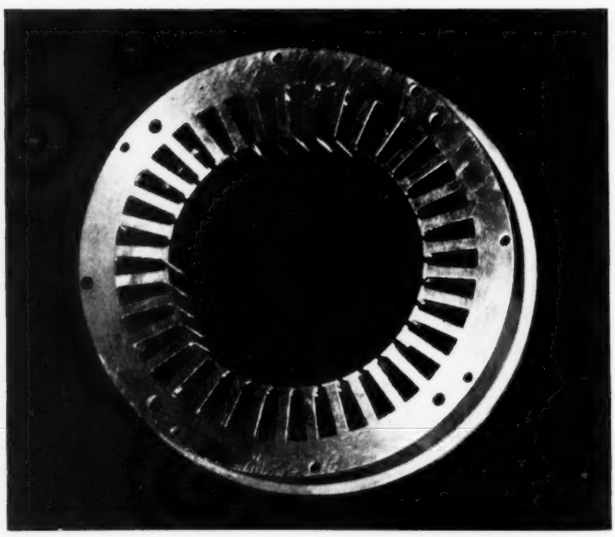


Fig. 1. Copper-brazed Stripper Plate for Compound Die Made from 0.020-inch Sheet-metal Punchings



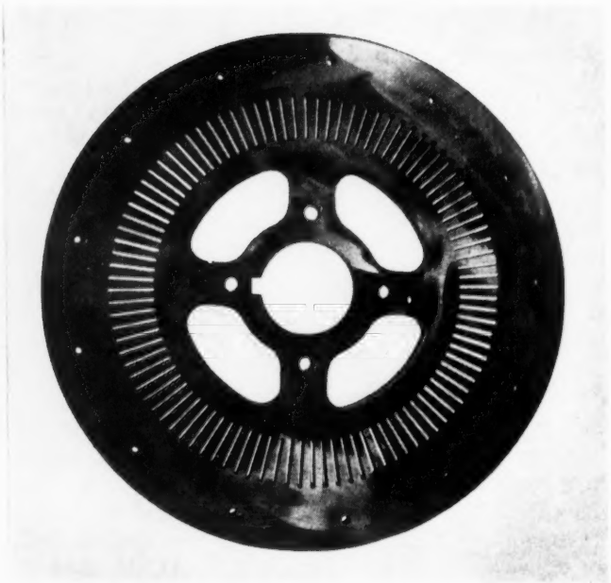


Fig. 2. (Left Center) Another Brazed Stripper Plate for a Compound Die Made from 0.020-inch Sheet-metal Punchings

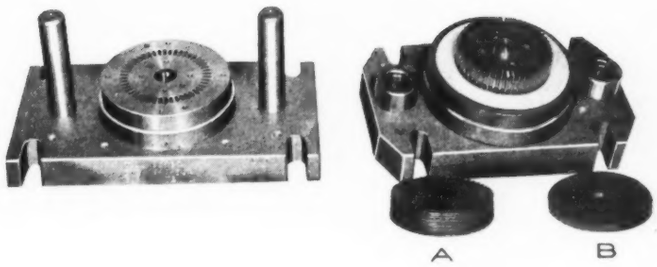
Fig. 3. (Left) A Stripper Plate for a Piercing Die Made from Sheet-metal Punchings, Brazed Together

TO obtain the best results in copper brazing, the design should be suitable for the use of this method. However, some assemblies that have not been specifically designed for furnace brazing, because they have been joined by other methods or machined from solid material, are often economically produced by copper brazing. In the applications illustrated in this article, an average saving of 50 per cent over the cost of previous methods has been effected.

The stripper plate for a compound die shown in Fig. 1 is made from 0.020-inch sheet-metal punchings. The stacked punchings are built up and clamped in an assembly fixture to keep the slots in alignment, and, while held under pressure, they are riveted or electric arc-welded to retain this alignment. A plate weighing approximately 5 pounds per square inch of surface of the punchings is placed on top of the stack of punchings to keep them from springing out of alignment while brazing. A sheet of asbestos paper is placed between this plate and the punchings to keep the plate from being brazed to the stacked assembly. After machining and polishing the brazed punchings, the joint is not visible to the naked eye. Fig. 2 shows another stripper plate for a compound die made from 0.020-inch sheet-metal punchings and brazed. This assembly is machined on the face and periphery.

In Fig. 3 is shown a stripper for a piercing die made from 0.020-inch sheet-metal punchings. This stripper is completely machined. The time for filing and fitting is approximately the same as for a stripper made from solid material, but all the time required for the machining of slots in a solid stripper is saved.

Fig. 4 shows a die in which the stripper and guide plates are made from punchings, brazed together. At *A* may be seen a stack of punchings



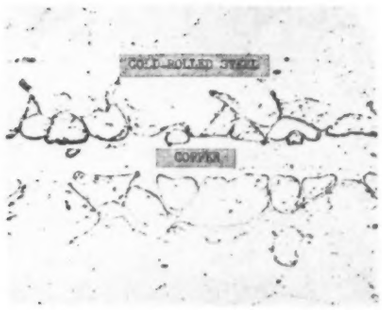


Fig. 4. (Left) A Die in which the Stripper and Guide Plates are Made from Punchings and Brazed
Fig. 5. (Right) Photomicrograph Showing the Bond between the Punchings at High Magnification

from which the stripper *B* is made. A photomicrograph, Fig. 5, shows the bond between the punchings at high magnification. There is a diffusion of the brazing copper into the steel along the grain boundaries. Tests have shown that the strength of the joint is equal to that of cold-rolled or low-carbon steel.

The example illustrated in Fig. 6 is a relay magnet core assembly. At *A* is shown a 1-inch shoulder pin which is brazed to a 5/8-inch thick angle-plate. It required a pressure of 26,000 pounds to break the joint between parts *A* and *B*. Note the shoulder raised on the angle-plate before the brazed joint failed. The completed assembly is shown at *C*. For brazing, a copper ring is placed around pin *A* and the brazing is done at the same time that the assembled magnet core and frame are annealed. The previous method of assembling this pin was to make it a press fit in the angle-plate and arc-weld the pin and plate together, grinding off the joint afterward. The new method, therefore, eliminates entirely the cost of welding and of grinding the welded joint.

Fig. 7 shows a spider assembly for a synchronous motor. The spider is cut out with the hydrogen and acetylene blow-torch from 6-inch steel plate and copper brazed. The copper brazing eliminates the beveling and welding of these plates, and makes a stronger bond at a lower cost. The spider is 17 1/2 inches long, 12 inches in diameter, and weighs 600 pounds.

The examples illustrated in this article will serve to indicate the broad field of application for which copper brazing is suitable.

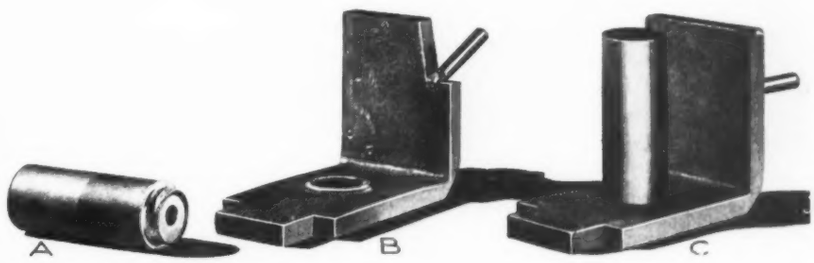


Fig. 6. A Relay Magnet Core Assembly in which a Shoulder Pin is Brazed to an Angle-plate

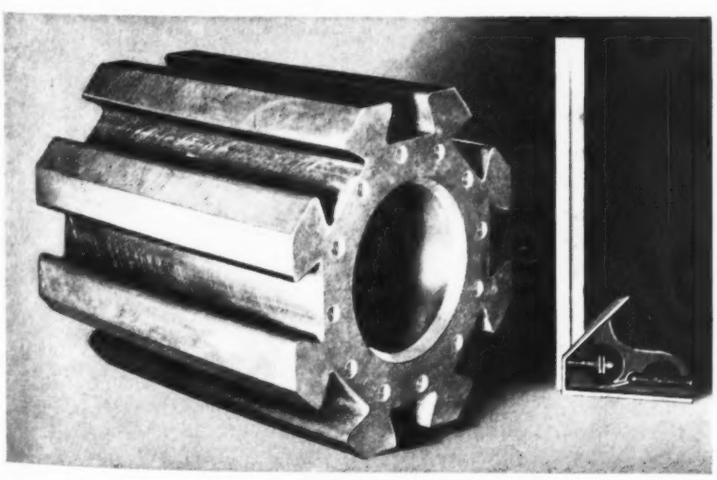


Fig. 7. A 17 1/2-inch Long Spider for a Synchronous Motor, Made from 6-inch Steel Plate Sections and Copper Brazed

Die Design and Construction

A Treatise on the Principles Embodied in the Design of Different Types of Sheet-Metal Blanking, Forming, and Drawing Dies—Eleventh of a Series of Articles

By CHARLES R. CORY*

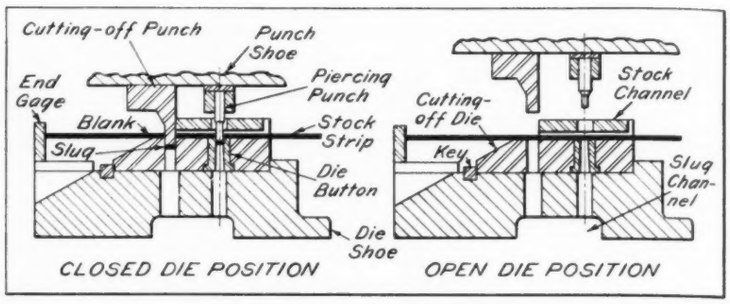


Fig. 1. Piercing and Cutting-off Die with Slug Type Cutting-off Arrangement

IN the articles published in the January and February numbers of MACHINERY, the principles of the shear type piercing and cutting-off die were illustrated and described. The present article will deal with the slug type, in which the blank is separated from the stock strip by cutting a slug from it. There are two shear lines in the slug type die (as was shown at *C* in Fig. 2 of the January installment, page 355), instead of one, as in the shear type. The blank and the stock strip remain stationary during the cutting operation, while the cut-off slug, as well as any slugs from pierced holes, travels down with the punches. A typical piercing and cutting-off die of the slug type is shown in Fig. 1. The cutting-off die proper and the die-shoe are so designed that the finished blank is shed off the die onto the bolster plate. If that is not possible, other means of blank disposal must be provided, or the operator must pick the blank off the die.

A slug type die is used only when the shear type is not suitable. The shear type die is less expensive to make, faster in operation, and wastes less stock. A slug type die is often used, however, if the two ends of the blank are not parallel, although a shear type die can be used even then, if the two ends of the blank are parallel part way, so as to hold the stock strip together at the cut-off line. In such a case, the part of the end shape which is not parallel is notched out of the stock strip in a previous stage. (See Fig. 3, page 356 of January MACHINERY.)

Another type of die for a part where the end outlines are not parallel for the entire width of the part is known as a piercing, cutting-off, and trimming die. This is a two-stage die, the first stage being the piercing stage, and the second, a combination cut-off and trimming stage. The outline of the front of the blank is produced by the cutting-off edge of the punch, and the part of the rear outline of the blank that differs from the front outline is trimmed by the back edge of the cutting-off punch, as shown in Fig. 2. One or more small pieces of scrap trimmed from the blank at the far end of the cut-off stage are left on top of the trimming die. They are either pushed off the die by the incoming stock strip or blown off by a jet of compressed air.

The addition of the trimming die sections at the far end of the cutting-off stage changes the method of blank disposal, since the blank cannot be shed endwise through the die, but, instead, is allowed to drop through the die-shoe to a blank channel. A die of this type can be used even when no parts of the end shapes are parallel.

Obviously, a slug type die could have been used instead of a cutting-off and trimming die for the operation indicated in Fig. 2, although the latter usually has the advantage of faster operation and less stock waste for about the same die cost.

*Die Engineer, Fisher Body Division, General Motors Corporation, Detroit, Mich.

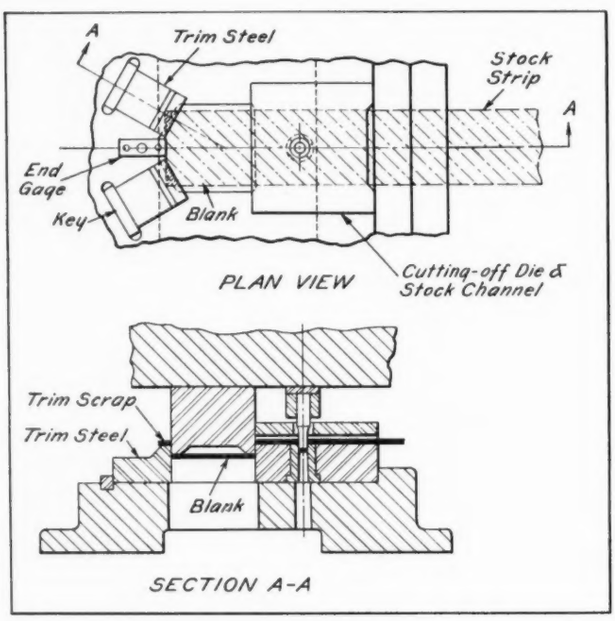


Fig. 2. Two-stage Die which Pierces in the First Stage and Cuts off and Trims Rear Outline of Blank in Second Stage

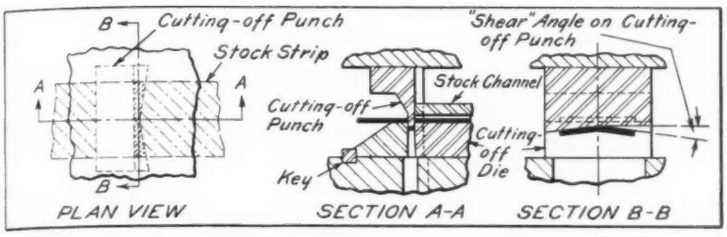


Fig. 3. Slug Type Cutting-off Punch with Shear Ground on Bottom Surface

The slug type of piercing and cutting-off die can be combined with forming, embossing, and flanging operations. These combinations will be dealt with in a coming article. It is easier to combine forming operations with a shear type die than with a slug type.

The cutting-off punch of a slug type die shears the stock strip along both the front and rear ends of the blank. It is fastened to the punch-shoe and is made of hardened steel. The minimum width of the slug cut out of the stock strip in a slug type die depends upon how slender the cutting-off punch can be made and still have sufficient strength. It must also be possible to harden the punch without danger of cracking.

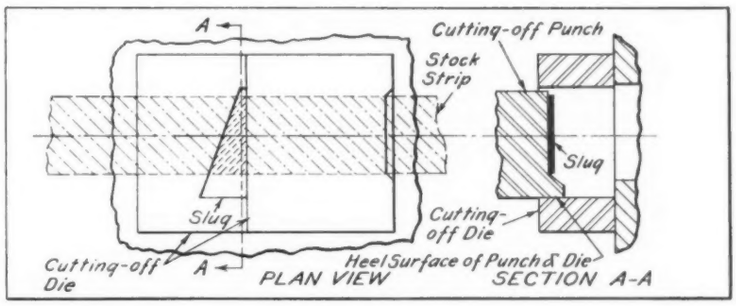


Fig. 4. Cutting-off Punch Supported by Die to Resist Thrust when Cutting Wedge-shaped Slugs

The punch usually has a flange, as indicated in Fig. 3, with sufficient area of base for screws and dowels and to prevent tipping. The punch can have shear ground on the bottom surface (see section *B–B*, Fig. 3), so that cutting will not start across the entire width of the stock strip at the same time. The shear on the cutting surface will distort only the scrap, which is in contact with it, and not the finished blank.

If the shape of the slug to be cut out is a wedge, there is a side thrust on the punch. This thrust creates a tendency of the punch- and die-shoes to shift in relation to each other. To prevent side pressure on the guide pins, heels should be added to the punch- and die-shoes. An optional construction is to have the cutting-off punch supported against the cutting-off die (see Fig. 4). This is done by fitting the punch against a side wall of the die to prevent shifting of the punch.

Construction of the Cutting-Off Die

The cutting-off die may be a single piece, in which the hole for the blank is machined, or it may consist of two sections with the punch passing between them. A solid die has the advantage of greater rigidity. It has the disadvantage, however, that the die hole may be hard to machine, especially if of intricate shape.

If the die hole is of simple shape, the punch can be made to suit the die, allowing for the regular side clearance. If the die hole is of complicated shape, the punch must be "sheared" into the hardened die before it is hardened, to obtain the proper fit. The "shearing" consists of machining the punch to the approximate shape of the die hole, allowing stock for finish-fitting. The soft punch is then forced into the die opening of the hardened die to make an indentation about 1/16 inch deep in the bottom surface of the punch. The punch is now machined to this indentation, and is made as much smaller than the indentation as the amount of the required side clearance. This is a relatively expensive method of fitting the punch and die.

When a two-section die is used instead of a solid one, the two sections can be "spotted" to fit the two side cutting walls of the punch. They are then located and doweled in place on the die-shoe, being spaced apart a distance equal to the width of the punch plus the die clearance. A solid die is usually employed for a relatively small slug hole, particularly if the shape of the slug does not require "shearing" of the punch in the die. The cutting-off die is made in two pieces if the slug is large, or if its shape is complicated enough to require shearing the punch into the die.

The cutting-off die is cut away at the far side of the cutting-off line, leaving only a cutting land, as shown in Fig. 5. This relief permits the finished

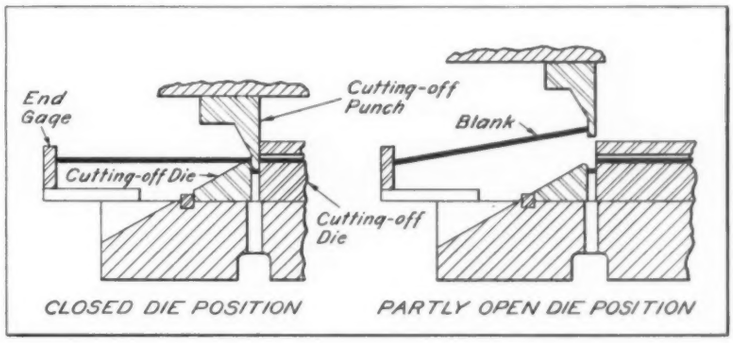


Fig. 5. Cutting-off Die Cut away to Permit Blank to Drop Down and Slide off the Die

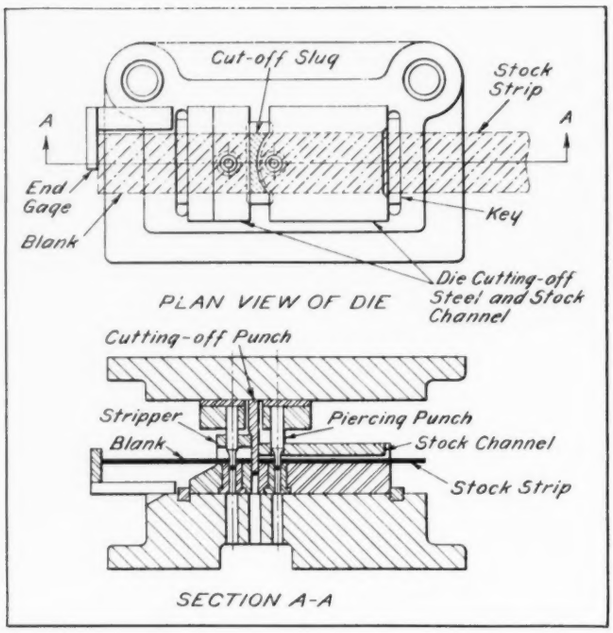


Fig. 6. Two-stage Slug Type Piercing and Cutting-off Die which Pierces Stock Strip and Blank Simultaneously

blank to fall down to clear the end gage and to slide off the die. On the up stroke of the press, the cutting-off punch pulls the finished blank upward, thereby releasing it from its "press fit" between the punch and the end gage, as indicated to the right in Fig. 5.

Keys are used to back up the die if two die sections are used instead of one, and if the stock strip is thick. Instead of using keys, the die can be backed up by shoulders machined in the die-shoe casting. There is a disadvantage in having both sections of the die backed up by the casting, since then the sections cannot be shifted to fit the punch. If only one die section is backed up by a shoulder on the die-shoe casting and the other by a key, the punch and the keyed die section can be assembled to suit the solidly backed-up die section.

Construction of the Die-Shoe

Heels are not usually necessary in the slug type die, since the endwise thrusts from the two shear lines practically balance each other. An exception is a die in which the shape of the slug creates an unbalanced cutting thrust sidewise, as already mentioned. This sidewise thrust can be taken care of by fitting the punch against the side wall of the die, as was indicated in Fig. 4, by casting heel bosses on the punch- and die-shoes to fit against each other, or by casting a boss on the die-shoe to fit against the punch.

The cut-off slug either drops through a hole in the die-shoe and then through a hole in the bolster plate, or through a hole in the die-shoe to a slug channel cored in the bottom surface of the die-shoe; or it can be shed sidewise to the bolster plate in the same manner as the pierced-hole slugs. This shedding of the slugs is similar to that described for other types of dies in previous articles in this series.

Two guide-pin bosses are located at the rear of the die, regardless of whether the stock strip is fed from right to left or from front to back for the sake of the operator's safety. The die-shoe casting should be cored to facilitate the shedding of the finished blanks. Ordinarily, the blanks are shed in the same direction as the stock feed.

Piercing in First and Second Stages

Holes can be pierced simultaneously on each side of the slug cutting lines, that is, both in the finished blank and in the stock strip. This is often done in the case of a long part that has holes close to each end, as indicated in Fig. 6. It is necessary to add a stripper for the punches beyond the cutting-off punch. This stripper is usually of the solid type, similar to the stock channel, except that the feeding slot in it is much deeper, so that the finished blank can tip and slide clear of the die. A spring stripper could be used for the piercing holes in the finished blank to make sure that the blank will fall at the gage end and slide clear of the die. A spring stripper travels up with the punch, leaving the finished blank entirely free.

* * *

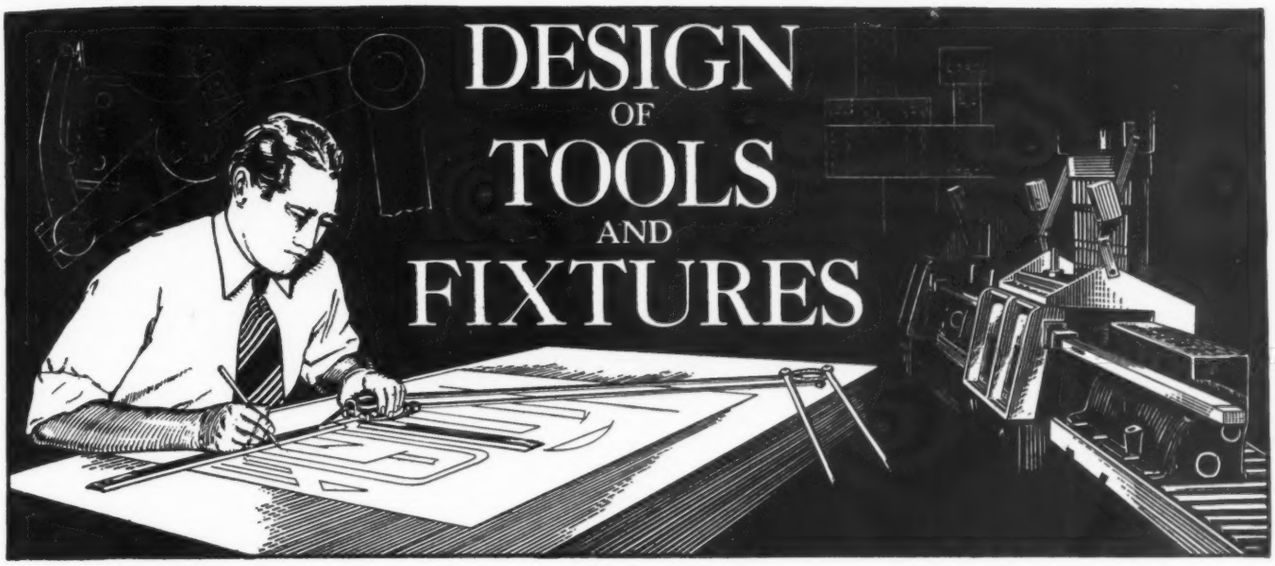
How the Wagner Act Should be Amended

In demanding amendments to the Wagner Labor Relations Act, the National Association of Manufacturers states that labor strife is unavoidable unless all people engaged in industry, whether as employers or employes, stand equally before the law. There can be no permanent solution of employer and employe relations until the right of free association on the part of employers, and freedom of action on their part (as long as they do not resort to unfair practices), is recognized to the same extent as it is in the case of employes; nor can there be any public confidence in the agencies established to administer the National Labor Policy unless all people have equal rights before the law, and the administrative agencies recognize the full and equal rights of employers to fair hearings and impartial decisions.

* * *

Automobile Production Increases Over Last Year

According to the Automobile Manufacturers Association, 366 Madison Ave., New York City, retail sales of passenger cars and trucks for the first two months of this year totaled 419,256 units, showing a gain of 35 per cent over the corresponding period last year. Increased truck sales also indicate better business prospects.



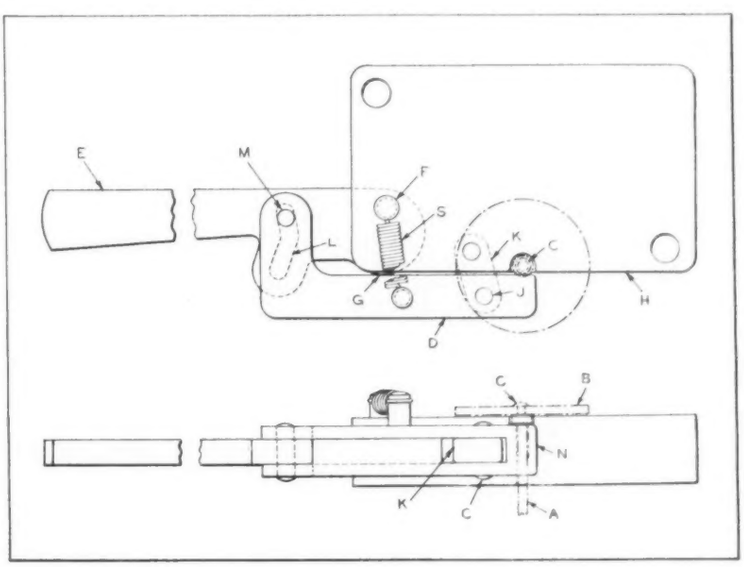
Riveting Fixture Equipped with Double-Acting Clamp

By JOHN J. McHENRY, Detroit, Mich.

The illustration shows a fixture designed to hold the spindle *A* and plate *B*, indicated by dot-and-dash lines, while assembling these two parts by forming the rivet head *C* in a Grant riveter. The feature of special interest is the double-acting clamp *D*, operated by the hand-lever *E*.

In the illustration the fixture is shown with the clamp in the closed position and with the two parts *A* and *B* assembled, ready to be released. Releasing of the work is accomplished by a single rearward movement of the double-acting lever *E*. As lever *E* is moved to the rear about the pivot *F*, the cam surface *G* releases the pressure on clamp *D* and clamp *D*, in turn, releases the pressure on the spindle *A* located in the groove in the fixture base *H*. During the clamping and unclamping movements clamp *D* pivots about the pin *J* in link *K*. Spring *S* keeps clamp *D* in contact with cam *G*.

Continued rearward movement of lever *E* brings the cam surface *L* of the slot in lever *E* in contact with pin *M* in clamp *D*, moving clamp *D* to the left until end *N* clears the spindle *A* of the work. The work can then be removed and replaced by a new piece. Swinging lever *E* forward causes the end *N* of the clamp to slide over the spindle *A*, clamping it securely in the groove in base *H* when the lever reaches the position shown.



Fixture with Double-acting Clamp Used in Riveting Part A to Plate B

Die for Producing Slotted and Flanged Header

By A. KEANE, Chicago, Ill.

The header *A*, Fig. 1, is pierced and flanged in one stroke of the die shown in the lower view and in section *X–X*, Fig. 2. The header is made from sheet brass, 0.020 inch thick, which has been blanked out in a previous operation. Sheet brass of the correct temper for forming the header was selected after trying several samples. There are twenty-two slots *B* in the header. Into each of these slots is soldered a flat-shaped tube. The complete assembly forms a radiator or heating unit.

The punch member of the piercing and flanging die is built on a standard punch-holder *C*, Fig. 2, while the die member is mounted on a standard holder *D*, equipped with leader pins *W*. The only work done on the

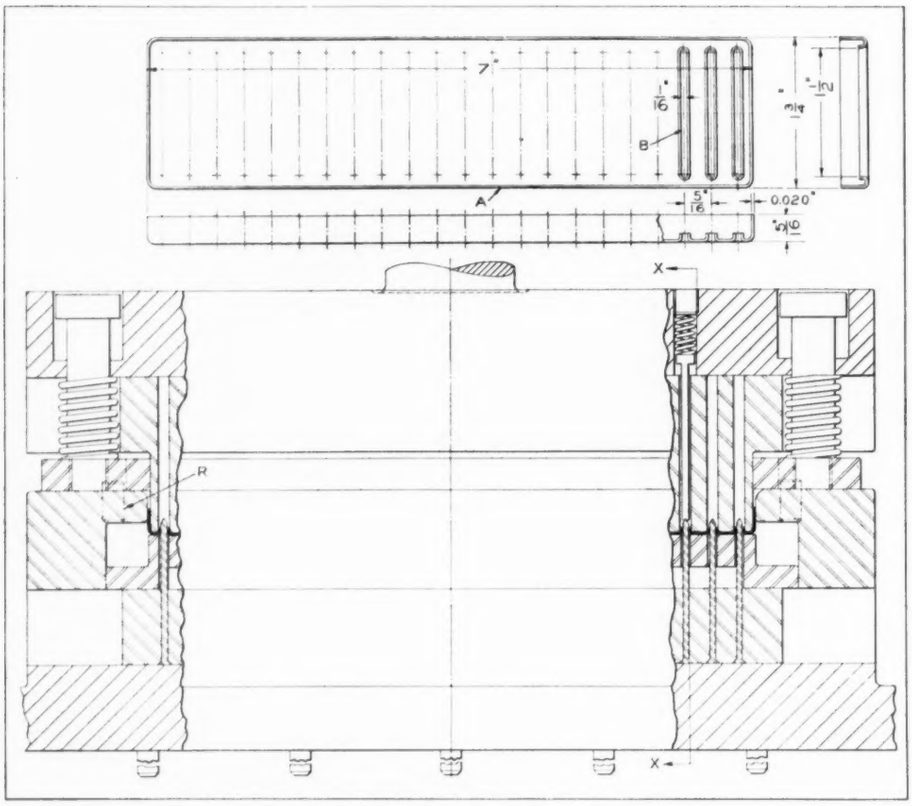


Fig. 1. Front View of Die Used in the Production of Brass Headers A for Heater Units

holders consisted of planing the slots and drilling and tapping the holes for use in holding the punch and die in place.

The knock-out or stripper *E* is actuated by two springs *F*. Five of these knock-out units are provided, which serve as safeguards only, since the metal will ordinarily cling to the slot-forming punches. Each knock-out *E* has a groove cut the entire length of the lower end to prevent it from dulling the edge of the punch.

Forming die *G* for the slots is made in two pieces, each of which resembles a comb. When constructed in this manner, it is a simple matter to finish the slots to size by milling. Die *G* serves also as a punch for the inside of the flange, which is formed around the edge of the header. This member of the die is made of oil-hardening steel. It is necessary for the slotting cutter to be kept sharp, as otherwise it will have a peening action which tends to distort the work.

Gibs *H* are employed to hold the die *G* in place in the holder. When the five screws in each gib are tightened, they lock the two comblike sections together. Gibs *I* hold the die member securely in the shoe *D*.

The combination pressure ring and stripper is shown at *J*. The header, being shallow, requires only a light pressure on the pressure ring during the drawing operation. However, the work tends to cling to the outside of the forming die *G*, from which it must be stripped. The drawing die *K*, for forming the 5/16-inch flange around the outside of the header, may be made from either cast iron or steel.

The combined pressure plate and stripper *L* exerts pressure on the metal while it is being cut and the slots are being formed. On the up stroke of the press, the formed header is stripped from the punches *M* by stripper *L*. Pressure is exerted on the combination pressure plate and stripper by ten pins, actuated by coil springs or an air cushion.

The metal in the slotted sections is not sheared, but is cut by the sharp edges *P* of the punches *M*, and is formed as the blank is pushed down by the

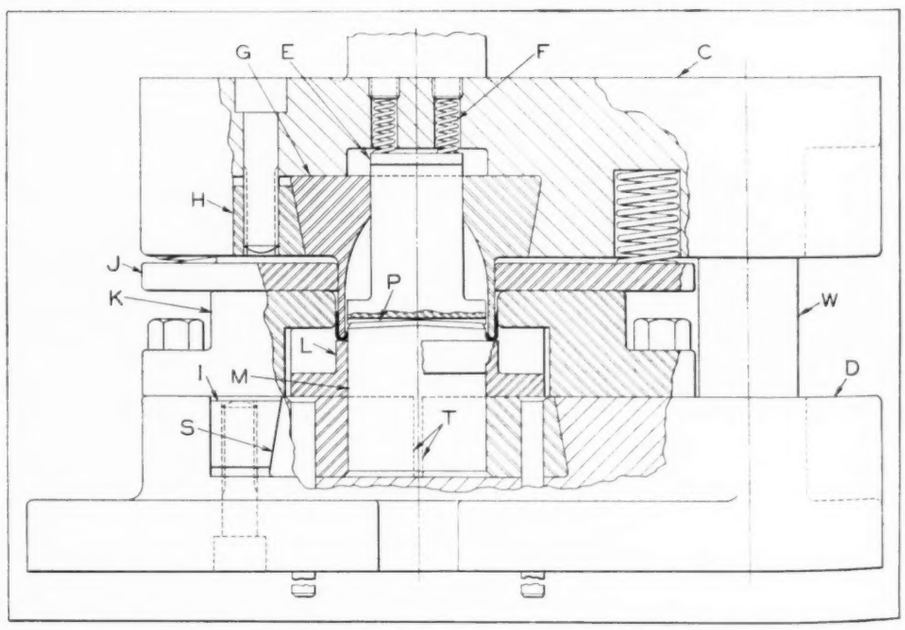


Fig. 2. Section X-X of Piercing and Flange-forming Die Shown in Fig. 1

forming die *G*. The punches *M* are made somewhat higher at their middle points than at the ends in order to facilitate the cutting action. All of the twenty-two piercing and forming punches *M* have heads formed by peening or riveting. These punches are made of tool steel and are hardened for a distance of approximately 1 inch from the top or working end.

The blank is located in the die by six pins *R*, Fig. 1, one pin being located at each end and two at each side of the die. Holes are drilled in the plate *J*, Fig. 2, to provide clearance for these pins when the die is closed. The pad *S*, which holds the punches *M*, is similar in construction to the die *G*, being made in two pieces, as shown by the dotted lines at *T*. The slots are beveled at the bottom to receive the heads of the punches. There is a clearance of about 1/8 inch between the inner ends of pads *S*. When clamped in the die shoe by gibs *I*, the two halves of the die lock the twenty-two punches securely in place.

Drill Chuck with Locating Pilot

By LEROY JAGOW, Buffalo, N. Y.

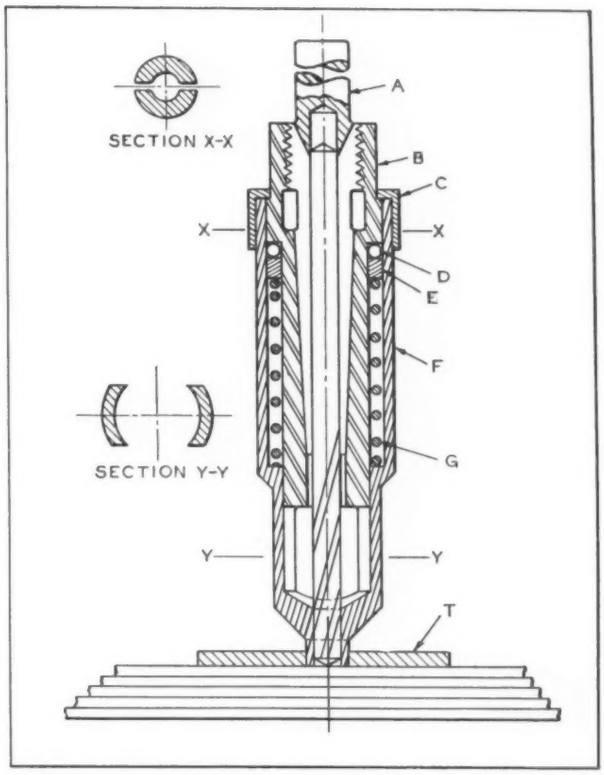
The accompanying illustration shows a drill chuck designed for use in drilling holes in sheet-metal blanks where the production is not large enough to warrant the use of expensive drill jigs or dies. This chuck can be used in either the conventional type of drill press or in a portable electric drill. It consists of a drill-holder or chuck *A*, chuck sleeve *B*, stop-ring *C*, steel balls *D*, ball race *E*, pilot sleeve *F*, and coil spring *G*. All parts are of steel, with the parts *A*, *B*, *D*, and *F* hardened.

The chuck *A* is tapered and slotted at one end and fits into a tapered hole in the sleeve *B*. The upper end of the chuck is threaded to fit the threaded hole in sleeve *B* and there are flats on the outside of the sleeve for a wrench. The drill is clamped in place by holding the shank of chuck *A* in a drill press chuck and screwing up sleeve *B*.

Section *X–X* shows the slot in drill-holder *A* which permits the holder to be contracted to obtain a powerful clamping action on the drill. The tapered section of chuck *A* is relieved slightly along the slot edges. A chip outlet is provided in the pilot sleeve *F* by milling flats that cut through the side walls just above the tip, as shown by section *Y–Y*.

The procedure followed in using this drill chuck is to pile up blanks to a total thickness of 1/4 to 1/2 inch. On top of the layer of blanks is clamped the templet *T* which has holes made to fit the tip of the drill chuck. These holes are accurately positioned to suit the drilling lay-out. The templet is made from sheet metal and is 1/16 inch thick.

The tip of the pilot sleeve acts as a bushing for guiding the drill and prevents enlargement of the holes in the templet, which invariably happens when a soft templet is used without hardened bushing inserts. With a pilot drill chuck of the type illustrated, the life of a soft templet is greatly increased, and in some cases, such templets never have to be replaced. In addition to this feature, there is a minimum of drill breakage, and drills can be reground for the entire useful life of the flutes. At present, this tool is being employed successfully in a large aircraft plant, but no doubt there are many other industries in which it will be found just as useful.



Drill Chuck with Pilot for Use with Drilling Templet

Dies for Forming Unusual Half-Cylindrical Shells

By M. J. GOLDSTEIN, New York City

The forming of shells that are half cylindrical in shape, with one closed end of spherical form and the opposite end open and flanged outward to form a pitcher spout, presents an interesting diemaking problem. The dies for producing the coffee pot spout and the small cream pitcher spout shown in Fig. 1 at *C* and *F*, respectively, are designed as shown in Figs. 2 and 3. The blanks for these spouts were produced in ordinary blanking dies. The shape of the spouts made it necessary to use a drawing die for forming the blank. The dies for both pieces were constructed alike, that for the larger spout being shown in Fig. 3.

The working parts of the dies are of cold-rolled steel, and the shoe- and punch-holders are made of

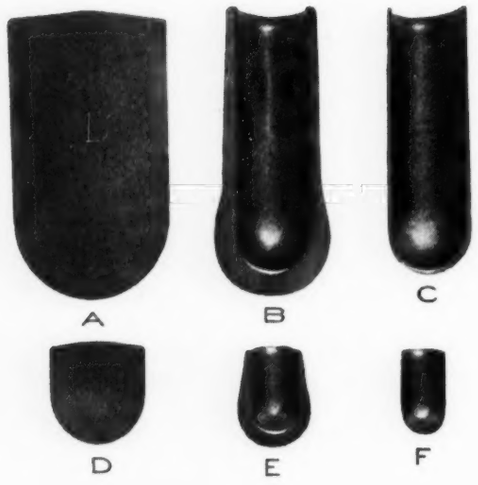


Fig. 1. Steps in the Production of Formed Metal Spouts for Coffee Pot and Cream Pitcher

cast iron. The larger spout is made to fit a cylindrical surface having a diameter of 4 inches, while the smaller spout is fitted to a cylindrical shell 3 inches in diameter. The face of the punch and the top surfaces of the pressure plate are machined to shape the edges of the shells to fit the cylindrical surfaces on which they are to be assembled. Section *X–X*, Fig. 3, of the punch and pressure plate shows how these members are formed to a radius of 2 inches, as required to make the spout fit the body of the coffee pot.

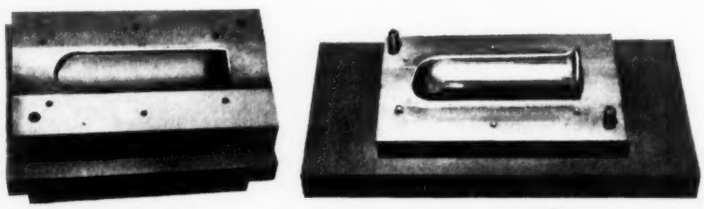


Fig. 2. Die for Forming Blank A, Fig. 1, to Shape Shown at B

Two pins are located in diagonally opposite corners of the pressure plate, as shown in Fig. 2, to align the die members properly. The small pins set in the pressure plate serve to locate the blank. The proper pressure is applied by a rubber "spring barrel," 4 inches in diameter by 6 inches long. The knock-out member is shaped to produce the flare on the lip of the shell.

The drawn shells are trimmed in dies of ordinary design, except that pilots are attached to the faces of the punches. These pilots are formed to the same radius as the faces of the pressure pads that are employed in drawing the shells.

* * *

In the twenty years since gasoline taxes were first imposed, it is estimated that a total of more than $8,000,000,000 has been collected from motor vehicle users.

Idle Men–Idle Machines–Idle Money

There are three fundamental reasons why recovery in the United States is so slow, says the National Industrial Conference Board in a bulletin recently published. These reasons are idle men, idle machines, and idle money. Since 1930, the waste of labor time through unemployment reaches the appalling total of 80,000,000 work-years. This problem becomes constantly more acute because the growth of the population adds about 600,000 new workers a year to the labor force.

Despite agitation for the forty-hour week, the average work week in manufacturing industries has not attained that level since 1931, and since 1932 has been eleven hours less that in 1929, the peak year of our prosperity. Idle men and shorter hours mean idle machines. Today, the machines that do the greater part of the work performed in modern industry stand idle about one-fourth of the time that they were in use in 1929.

The amount of money lying practically idle is greater today than at any previous time in our history. We have more money to lend for productive purposes than ever before. The proportion of loans to our total bank deposits and net capital funds averaged 39 per cent for the last five years, as against 63 per cent for the preceding eleven years. The surplus of bank deposits and net capital funds over total loans and investments has more than trebled in the last five years.

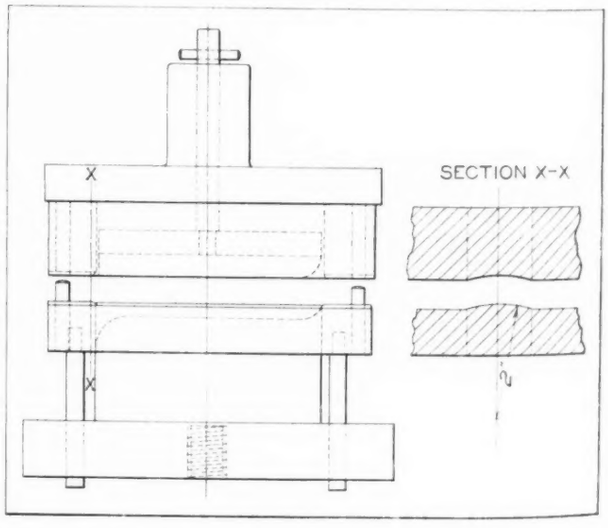


Fig. 3. Assembled Members of Punch and Die Shown in Fig. 2

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Solicitors Selling Small Domestic Machinery

P. S. B.—When and under what circumstances can a city compel a solicitor to pay a license fee? We employ solicitors who occasionally deliver goods or collect money as down payments. In such a case, are the solicitors required to pay municipal license fees?

Answered by Leo T. Parker, Attorney-at-Law
Cincinnati, Ohio

The law is established that neither a city, county, nor state may pass an ordinance or law which interferes with interstate commerce. A manufacturer located in one state has the privilege, without regard to license laws, of sending a representative into another state to solicit orders for merchandise shipped from the state in which the manufacturer is located.

If, however, the manufacturer sends a representative into a foreign state and such representative makes deliveries from stock stored in the foreign state, this is not interstate business, and the representative may be compelled to pay the license fee to transact the business. Obviously, a city may pass an ordinance preventing the sale of specified commodities by solicitors, provided the sales are intrastate business and not interstate business.

It has been held that the mere fact that a salesman collects money with an order does not change the status of interstate business; but if he simultaneously solicits, delivers the goods, and collects money, he is doing intrastate business, and therefore must pay state, county, and city license fees.

Variation in Press Tools after Storage

D. L.—We occasionally have trouble with certain of our press tools when they have been out of use for six months or so, and we should appreciate the views of readers of MACHINERY as to the possible cause of the changes that take place in these tools.

We have considered the possibility of the movement of the cast-iron bolsters, although we endeavor to season our bolsters for several months. We should be particularly interested to hear whether the varying effects of temperature and humidity are likely to cause a permanent alteration of the tools. We experience no trouble from rusting, as the tools are well oiled before being stored.

A.—It is difficult to give an opinion on the causes of press tool deterioration when no definite clue is given as to the faults that have become manifest, other than the statement that rusting is not one of the troubles. It will be as well, therefore, to assume that the tools have at some time functioned satisfactorily, but that now the work does not meet the requirements as regards accuracy and finish.

To give good results at first the tools must have been dimensionally correct within the allowable limits set by the inspector. Something must have happened during storage to alter one or more of these correct dimensions. In the case of a blanking or piercing tool built up on a cast-iron bolster, the bolster may have warped because of the gradual release of residual casting strains. Seasoning of the casting alone is not sufficient to prevent subsequent distortion. The casting (for really good results) should be roughly machined, then seasoned for as long as is practicable, remachined, again seasoned, and finally machined, taking as light cuts as possible. All bulk removal of metal, such as from large apertures, should be performed before the final seasoning operation. It is as well also to verify the flatness of the bolster by dismantling the tool after the first try-out, in case unduly tight dowels have caused distortion.

The lower surface of the die should be examined for flatness, as it is quite likely that the die may have warped during storage due to the release of hardening strains. Here, again, a seasoning operation, followed by light surface grinding, will obviate the trouble. If the die has been resharpened with an unsuitable wheel, or with undue haste, warping, if no more serious trouble, may have resulted.

If the punches have been badly fitted into the punch-plate when first assembled, and peened up to conceal the fault, it is probable that time will release some of the peening strains and the punches will not maintain their original alignment. Small punches having a small bearing area at the top end tend to sink into the punch-holder under heavy duty, becoming loose in the punch-plate, so that alignment is not assured.

All tapped holes should have been countersunk for the depth of one thread to insure proper contact between the various parts to be screwed together. Otherwise, the contact area may consist of a very narrow ring around each hole, which will yield during operation, resulting in looseness and faulty alignment.

Pilots, stops, and guides may have become worn during the first run of the tool, the tool-setter having made allowances for this during use, but having omitted to do so when the tool was again put into service after an interval of time.

The press itself may not be guiltless. Press beds

are subject to considerable ill-usage. Hammers and heavy spanner wrenches dropped on a machined surface do not improve it. Constant clamping down of press tools causes gradual departure from flatness of the heaviest of press beds. The press, moreover, may have been overloaded at times, the alignment between ram and bed being thereby affected.

In the case of pillar press tools (or sub-presses), it is possible that excessive pressure was used in forcing the pillars into place. This would cause subsequent distortion.

Where bending tools are concerned, a prolific cause of trouble is variation in the thickness of the stock. Each consignment may be different, and a tool correct for one thickness may be altogether unsatisfactory should the thickness differ by a few thousandths of an inch. Differences in the hardness of stock may produce unsatisfactory results. A few months between deliveries of stock may show considerable variations in both these respects.

Most bending tools consist of a number of strips bolted together in a suitable bolster, together with some form of sliding pad which is held forcibly against the bolster at the bottom of the press stroke. Most, if not all, of these parts are hardened and should be ground on all mating surfaces to insure permanent satisfactory contact. Normalizing before hardening, seasoning, and rough-grinding should precede the finish-grinding to minimize distortion.

Stock above normal thickness passed through such tools may impose severe strains on the bolster, and after a time, distortion will become evident. Careless press setting may impose similar strains. If rubber buffers are used, it is not unknown for them to expand in diameter until the hole in the press bed is filled. The full force of the descending ram is then concentrated on the buffer pressure-pins. As these occupy but a small proportion of the area of the tool pressure-pad, the latter is subjected to severe local bending strains, again with consequent distortion.

With any type of tool, the hole in the press bed should be the smallest possible for the work to be done. With a large hole, the tendency is to bulge the bolster into the hole. If a filler plate is used, the thickness should be verified, since a thin plate might as well not be there, and an excessively thick plate will have the effect of bowing the tool upward when the clamps have been tightened.

Unsuitable tool steel or faultily hardened tool steel of the right brand may lead to another set of troubles, such as crumbled edges, scored surfaces, or sunken parts on tools. These may not have been noticed during gradual deterioration in the first run, but will be reported on promptly by a new inspector with a fresh outlook on the job. It is quite likely that this condition is responsible for most of the trouble experienced.

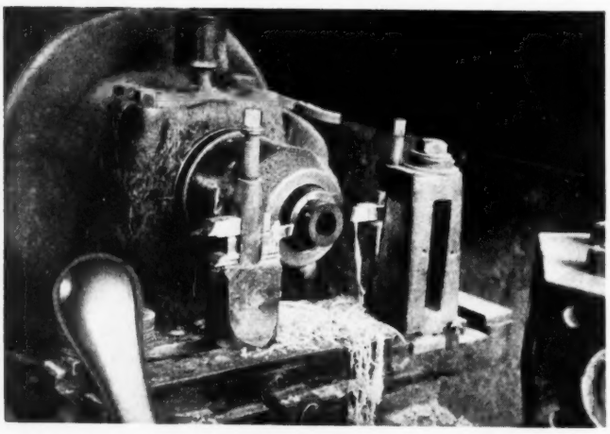
A policy the writer has often advocated is to retain a sample of work turned out by each tool just before removing it from the press. This sample is kept with the tool in storage and compared with the first samples turned out after resetting. In all cases, the tool inspection department should keep a complete set of samples made when the tools are first placed in commission. I. C.

* * *

Operating Costs of Automobiles Reduced

Since 1925 the operating cost of a popular priced car has come down 40 per cent as a result of improved designs. This decline is shown by data contributed by six different companies operating a total of 30,000 motor vehicles in all kinds of weather, over rough roads and smooth, which has been compiled by the Automobile Manufacturers Association. The decrease in costs is attributable to improvements in road conditions and to the strides made by automobile and tire manufacturers in providing better materials and designs.

Engineering records also show that, with the economy models of low-priced makes of cars today, two or three miles more per gallon can be obtained, at the same speeds, than with the corresponding models ten years ago, but this is frequently offset by increased acceleration and higher road speeds.



Stellite J-Metal is One of the Cutting Materials Especially Suitable for Turning Synthetic Plastics. The Illustration Shows the Turning of Catalin at a Surface Speed of About 1150 Feet per Minute

Machining Tough Forgings for Large Roller-Bearing Races

By I. F. YEOMAN

Special Tooling Equipment is Employed on Automatic Turret Lathes to Maintain Close Tolerances on Boring, Turning, and Facing Work

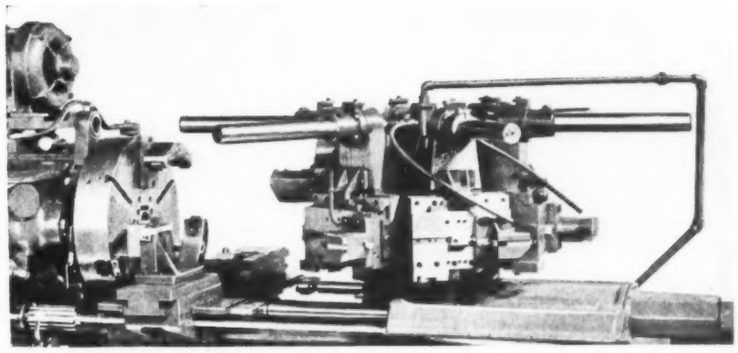


Fig. 1. "Fastermatic" Automatic Turret Lathe with Special Tooling Equipment for First Chucking Operations on Roller-bearing Race

THE outer races of large tapered roller bearings for railroad car trucks are machined from tough forgings designated as Krupp steel. The approximate dimensions of one of these races are shown in the cross-section view at *W*, Fig. 2. The turning, facing, and boring operations performed by the equipment shown in the accompanying illustrations hold the work to the required dimensions within very close tolerances. Following these accurate machining operations, the races are heat-treated and ground to the final dimensions.

The special tooling equipment employed to meet these exacting requirements was designed and built by the Foster Machine Co., Elkhart, Ind., and applied to two 4-F Universal Fastermatics of this company's manufacture, as shown in the illustrations. With some modifications, however, this special tooling equipment could be used on any ordinary turret lathe of similar capacity having bridge type cross-slides.

The first chucking operations on the ring *W*, Fig. 2, include facing one side of the work, completing the rough- and finish-boring, and chamfering the inside of the ring. The machine used for these operations, as shown in Fig. 1, is equipped with a 32-inch three-jaw air-operated chuck. This chuck (Fig. 2) has serrated master jaws *A* to which are attached rocker type compensating jaws *B*.

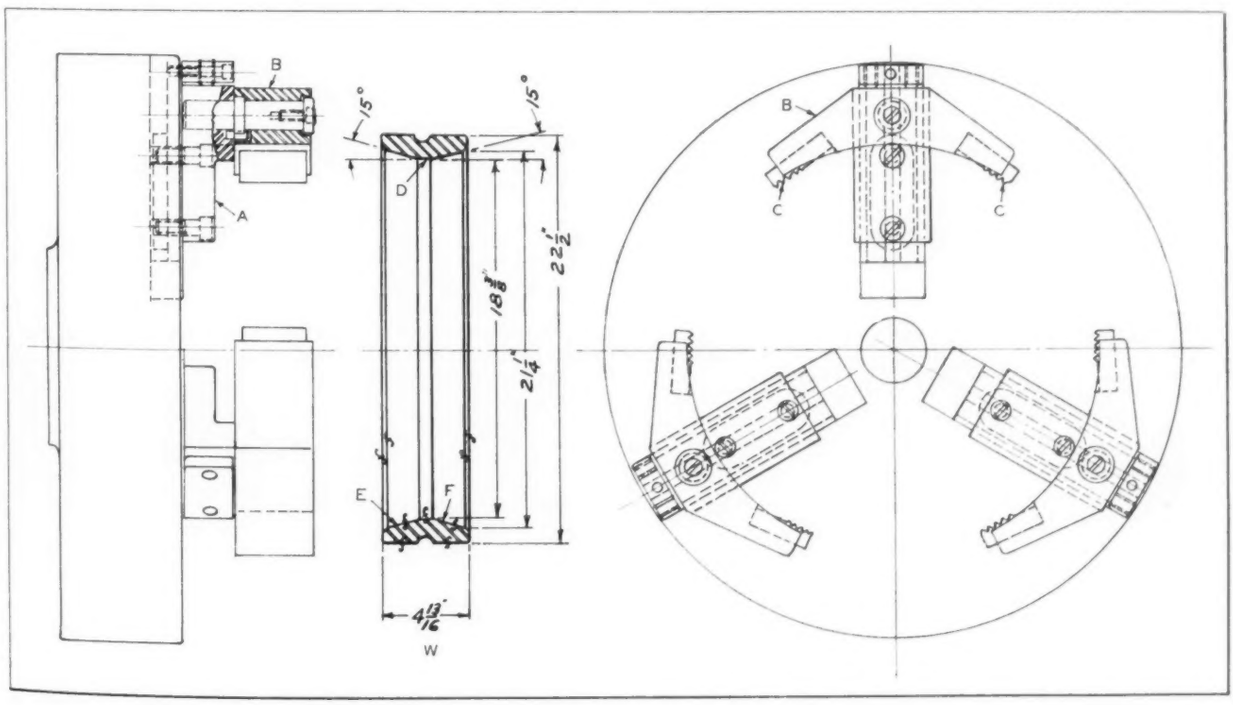


Fig. 2. Chuck with Equalizing Jaws, Used in Set-up Shown in Fig. 1 for Holding Bearing Race Forging

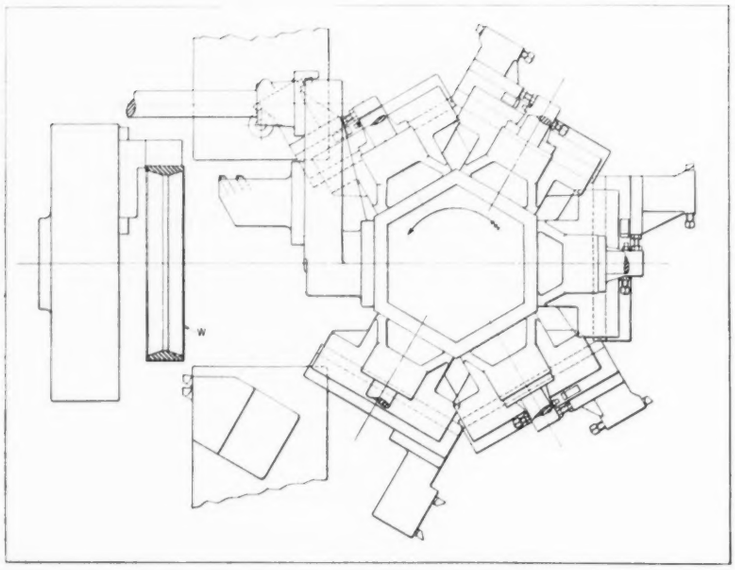


Fig. 3. Tooling Set-up for First Chucking Operations on Work W

Since considerable stock must be removed from the extremely tough material, it is necessary to grip the work very securely. The clamping pressure, however, must be applied in such a manner as to avoid closing or distorting the work.

Embedded in the ends of the rocker jaws are corrugated hardened steel pads *C*, each of which covers a large area of the work. Thus when the jaws are closed, the race is gripped at six points, the gripping pressure being equalized over these points. With this method of chucking, little, if any, distortion is caused by the pressure of the jaws.

The first of the boring operations consists of rough- and finish-boring the straight portion *D* at the intersecting point of the two tapers. The equipment consists of a simple multiple-tooled boring-bar attached to an ordinary overhead piloted turning head, as shown in the tooling set-up diagram, Fig. 3.

The tapering bores *E* and *F*, Fig. 2, are finished by overhead piloted slide-heads, one of which is shown in Fig. 5. The angular movement required to produce the desired taper is obtained by means of cams. Referring to Fig. 5, *A* represents the rear cross-slide cam of the Fastermatic, and *B* the rear cross-slide. As the hexagonal turret feeds forward under rapid traverse, the rear cross-slide feeds to the position shown. When the cam *A* brings the roll *C* on slide *B* into the dwell portion of cam-slot *D*, the cross movement of the slide ceases, and it is held rigid, with the roll *C* in position to enter the cam portion of slot *D*. This cam is adjustable and is secured to the under side of the tool-carrying slide *E*.

The continued forward feeding movement of the turret brings the roll *C* into the cam portion of slot *D*, which causes the cutter *F* to be fed into the work with the correct movement for generating the taper. Accurate adjustment of the cutter *F* is effected through screw *G*. At the completion of the cut and the start of the return movement of the turret, the cross-slide moves outward, withdrawing the cutter from the work and thus preventing tool

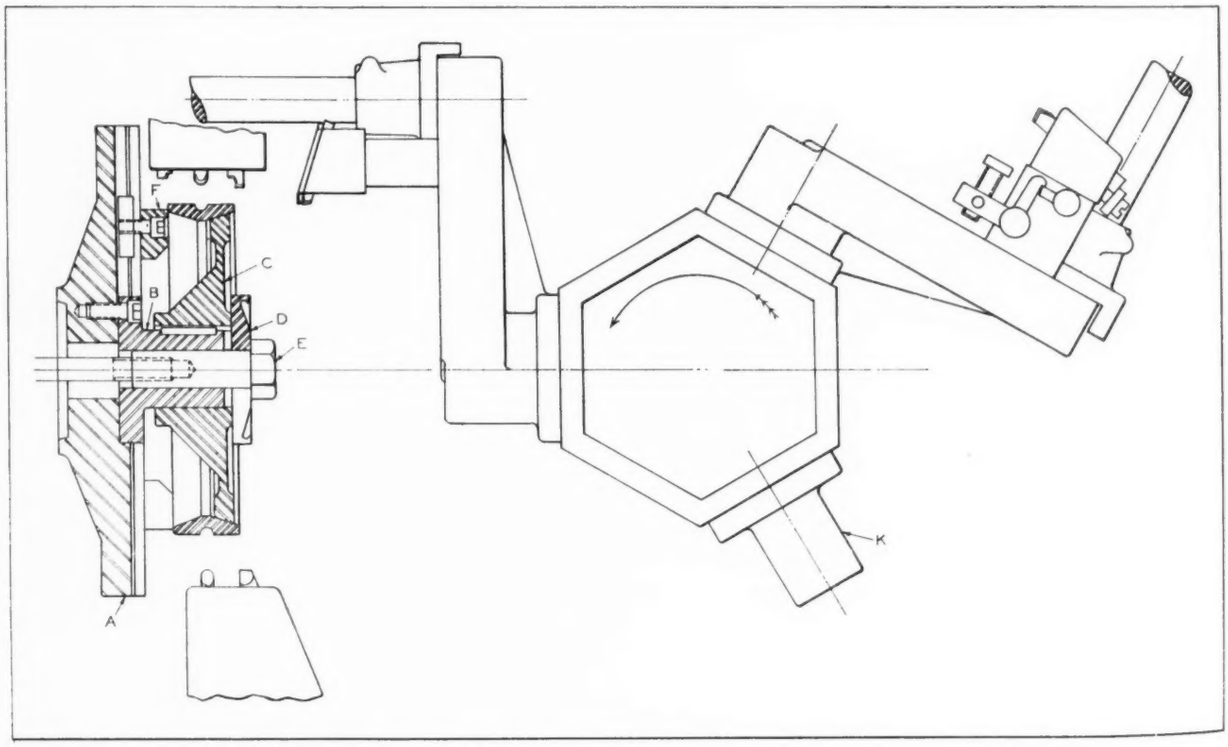


Fig. 4. Chuck and Special Tool Set-up for Second Chucking Operations on Bearing Race

marks. The slide is retained in the returned position by means of spring pressure. The position is determined by the abutment of a lug against the screw *H*.

In the sequence of operations completed during the first chucking, each internal surface is rough-bored before any of the finish-boring operations are performed, except those that take place at the sixth

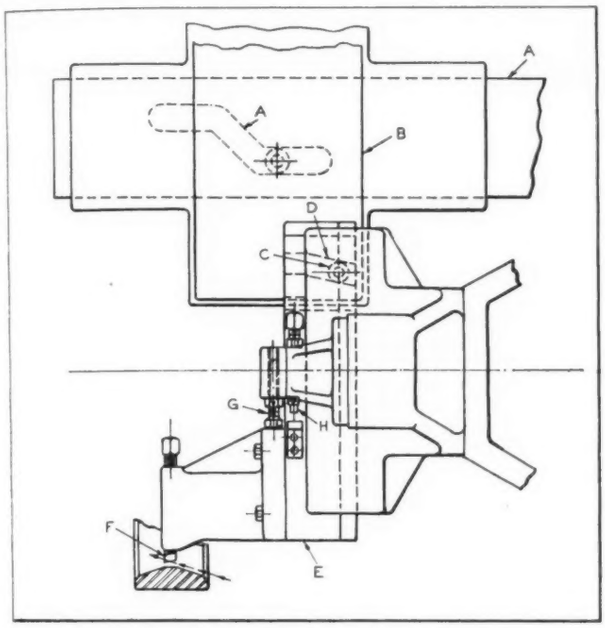


Fig. 5. Special Slide-tool Designed for Boring Taper in Bearing Race

station of the turret. A chamfering operation on the two edges of the bore is completed at this station by a cutter-bar attached to a sliding head that is identical in construction to those used for the taper boring.

The machine tooled for the second chucking operations, which consist of rough- and finish-turning the outside diameter, grooving and facing one side, and rounding the corners, is shown in Fig. 6. The work is chucked on an adapter shown in Fig. 4. The adapter consists of a large hardened steel plate *C* which fits over the arbor *B* and is ground on the outer rim to fit the taper bored in the race during the first chucking. The C-washer *D* fits over the air-operated draw-rod *E*, which clamps the washer and plate *C* against the tapered bore of the race and also clamps the work against the parallel blocks *F*. The plate *C* locates the race centrally. This plate has a keyway machined to slip over a key embedded in the arbor *B* to insure a positive drive.

The tools for completing the turning operations are the ordinary overhead piloted multiple turning heads and angular cutter-holders supporting Stellite No. 2400

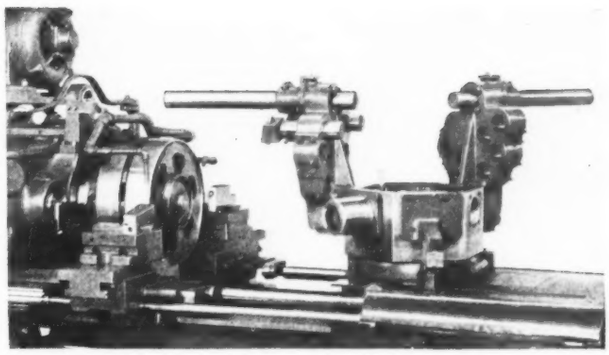


Fig. 6. Fastermatic with Special Tooling for Second Chucking Operations on Bearing Race

cutting tools. No further description is necessary, except to state that the cutter-holder shown in Fig. 7, which is used for the finish-turning cut, is so designed that it raises the cutter clear of the finished surface on the return movement, thus eliminating tool marks. The shank of this cutter-holder has a dovetailed slot for the slide-block *A* which supports the cutter. A slot is milled across the back of this block. A round hardened cam *B*, on which a flat is milled, passes through the slot in the slide-block and also forms a bearing member between the slide and the body of the tool.

The spring *C* exerts an upward pressure against the slide-block. The lever *D* is attached to the cam *B*, and when in the position shown, the cutter is located correctly for the turning operation. The pawl *E* retains lever *D* in a fixed position; thus cam *B*,

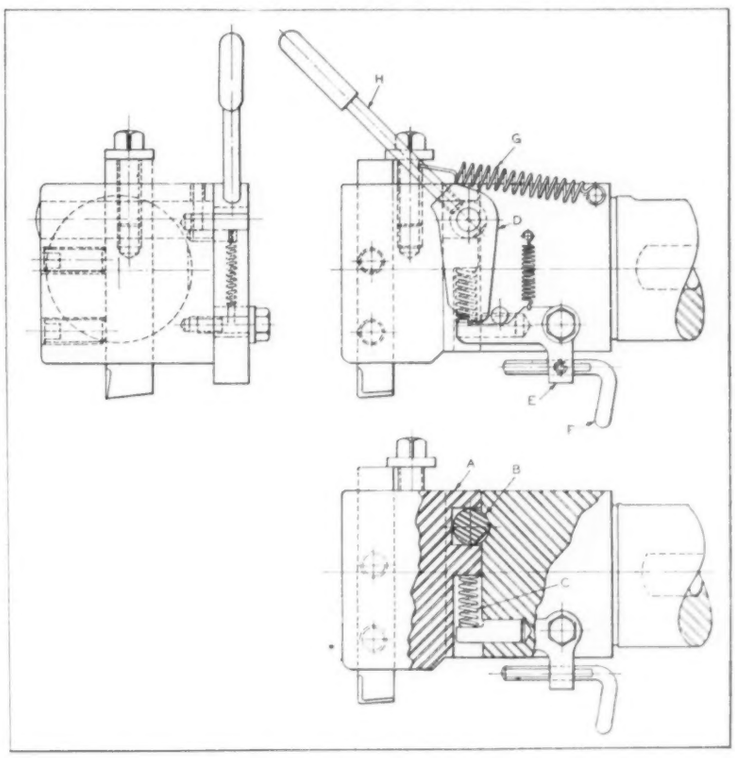


Fig. 7. Special Turning Tool with Cutter-holder that is Withdrawn on Return Movement to Eliminate Tool Marks

being held in the position shown, retains the slide-block and cutter in their working positions. At the end of the turning cut, the rod *F* comes in contact with the work. A slight continuation of the feeding movement swings pawl *E* clear of lever *D*. Spring *G*, through lever *H*, then throws the flat side of cam *B* into a position parallel to the slot across the slide-block, thus allowing spring *C* to raise the block and cutter clear of the work. The cutter is reset to the starting position by means of the hand-lever *H*. This type of tool is useful on many other kinds of machines.

Again referring to Fig. 4, the holder *K* is used for loading the plate *C* on the arbor and for its removal. For this operation, the longitudinal movements of the turret are hand-controlled, so that lifting of the plate on the part of the operator is not necessary.

* * *

Gear Manufacturers to Meet at Virginia Beach

The American Gear Manufacturers Association is planning to hold the 1939 annual meeting at Hotel Cavalier, Virginia Beach, Va., May 15 to 17. A well rounded program has been prepared for the meeting, covering a great number of subjects of interest to the gear manufacturing industry. Among the subjects to be dealt with are modern drafting practice; surface hardening of gear teeth; gear metallurgy; automotive transmissions; materials for worm-gears; turret lathes in the gear shop; and industrial safety.

Lubricants for Tapping

According to the experience of a plant in Great Britain where a great deal of tapping is being done, lard oil has been found to be an excellent tapping lubricant; but in view of its high cost, it is often too expensive for general use. There are, however, available on the market, compounded oils obtainable at a reasonable price that have the main characteristics of lard oil. These oils are mixtures of fixed and mineral oils, in which the latter constituent may predominate, or mixtures containing fatty oils. One of these mixtures, for example, consists of 25 per cent lard oil and 75 per cent wool fat, carefully blended and free from mineral oil. This mixture is said to have all the properties required for a good tapping lubricant. Another mixture that has given good results consists of 25 per cent lard oil, 25 per cent wool fat, and 50 per cent mineral oil. While not so efficient as the mixture previously mentioned, it is correspondingly less expensive.

* * *

Depression and Recovery in the United Kingdom and the United States

A four-page folder entitled "Economic Equilibrium—The Cure for Unemployment," has been prepared by E. S. Pillsbury, president of the Century Electric Co., St. Louis, Mo., on the basis of information available in a recently published bulletin of the National Industrial Conference Board. The leaflet is available by addressing the Century Electric Co., 1806 Pine St., St. Louis, Mo.

Westinghouse Annual Machine Tool Forum

THE Westinghouse Electric & Mfg. Co.'s Machine Tool Electrification Forum was held at the Westinghouse plant in East Pittsburgh, Pa., April 18 to 20. Over one hundred representatives of machine tool building concerns were present, discussing new applications of motors and controls to machine tool drives. Addresses were made both by engineers engaged in the machine tool industry and by Westinghouse factory and field engineers. The discussions covered specific applications of electrical equipment to machine tools of various classes, advances made toward the standardization of electrical equipment, and new design trends, particularly for machine tool application.

Wendell E. Whipp, president of the National Machine Tool Builders' Association and president of the Monarch Machine Tool Co., Sidney, Ohio, spoke to the assembled engineers, giving them what he termed "a message from the machine tool industry." Among other addresses were: "Arc Welding in Machine Construction," by W. A. Maddox, welding supervisor, Cincinnati Milling Machine Co.; "Gearmotors Simplify Design Problems," by C. B. Connell, Westinghouse application engineer; "Cost Advantages and Limitations of Electric Drive," by R. S. Elberty and W. E. Happel, Electrical Engineering Department, Landis Tool Co.; "Reversing Motor Duty," by R. W. Monroe, of the Westinghouse Motor and Generator Section; "Small Motors in Machine Tools," by L. R. Botsai, sales manager, Westinghouse Small Motor Division; "Determining Motor Size and Characteristics for Machine Tool Service," by W. F. Ridgway, development engineer, Ingersoll Milling Machine Co.; "Streamlining in Machine Design," by Herbert Rosengren, design consultant, American Machine and Foundry Co.; "Progress in Electrification of Large Machine Tools," by G. A. Spohn, electrical engineer, General Machinery Corporation; "Purchasing Machine Tool Equipment," by J. R. Weaver, director of equipment, inspection, and test of the Westinghouse company; and "Applying Electrical Drive for Planer Auxiliaries," by George Heiber, chief engineer, Cincinnati Planer Co.

Repair and Maintenance of Electric Motors

By J. L. BROWN
Industrial Motor Engineer
Westinghouse Electric & Mfg. Co.

Methods Employed in Repairing Worn Motors and in Making and Fitting New Parts—Second of Two Articles

THE first installment of this article, published in April MACHINERY, dealt with the subjects of obtaining properly fitted keys and keyways, tolerances for shaft diameters and bores of pulleys and pinions, the making of repairs by welding, materials used for replacement shafts, the machining of replacement shafts, and the making of ball-bearing replacements. The present article will deal with the use of bearing bronze for sleeve bearing replacements and babbitt-lined bearings.

Using Bearing Bronze for Sleeve Bearing Replacements

Whether or not the original bearing is of bronze, a tolerably satisfactory replacement can be made from a bar of bearing bronze. If a piece of this material is available, it will prove the easiest means of making a replacement in the average repair shop. The correct external dimensions, and also the size and locations of the oil-grooves, should be determined by referring to the old bearing, but the bore diameter must usually be determined from the journal. The bearing surface may be so badly damaged that it cannot be measured properly and the journal may be damaged to the extent of rendering it necessary to turn it to a new diameter in order to secure a suitable bearing surface, as described in the preceding article. When the journal diameter is determined, the bearing bore can be fixed by adding to the journal diameter the allowances given in Table 2.

Table 2. Allowances, in Inches, Added to Journal Diameter to Obtain Diameter of Bearing Bore

Nominal Bearing Bore, Inches	Oil Lubrication		Grease Lubrication
	Babbitt Bearings	Bronze Bearings	Babbitt and Bronze Bearings
3/4 to 1	0.0015 to 0.0025	0.0015 to 0.0025	
Above 1 to 1 1/4	0.003 to 0.004	0.003 to 0.004	
Above 1 1/4 to 2	0.0035 to 0.005	0.0035 to 0.005	0.005 to 0.007
Above 2 to 2 1/2	0.004 to 0.006	0.004 to 0.006	0.006 to 0.008
Above 2 1/2 to 3	0.005 to 0.007	0.006 to 0.008	0.008 to 0.010
Above 3 to 4	0.006 to 0.008	0.007 to 0.009	0.010 to 0.012
Above 4 to 5	0.007 to 0.009	0.009 to 0.010	0.012 to 0.014
Above 5 to 6	0.008 to 0.010	0.009 to 0.011	0.014 to 0.016
Above 6 to 7	0.009 to 0.011	0.010 to 0.012	0.016 to 0.018
Above 7 to 8	0.010 to 0.012		
Above 8 to 9	0.011 to 0.013		
Above 9 to 11	0.012 to 0.014		
Above 11 to 13	0.013 to 0.015		
Above 13 to 15	0.014 to 0.016		
Above 15 to 17	0.015 to 0.017		
Above 17 to 19	0.015 to 0.018		
Above 19 to 22	0.016 to 0.019		
Above 22 to 28	0.018 to 0.021		

If the shaft runs at high speed and the bronze material used is one of the harder varieties, it may be desirable to provide a tinned surface directly in contact with the shaft. This can be accomplished by increasing the diameter of the bore 0.005 or 0.006 inch, heating the bearing, fluxing the surface to be tinned, and using a tinning alloy consisting of one part tin to two parts lead. The coat of tinning alloy should be thick enough to permit obtaining a smooth bored surface when the bearing is rebored to the correct diameter.

Babbitt-Lined Bearings

It may be desired to provide the bearing with a babbitt lining, in which case the bore is made about 1/8 inch larger than the nominal size. The surface of the bore is then tinned as previously described. A suitable mandrel is provided to form a center hole about 1/8 inch smaller than the finished bore, and the babbitt is poured between the tinned surface and the mandrel, which has been previously heated. The excess babbitt can then be bored out to give the correct finished diameter.

In the interest of accuracy, it is preferable to leave a small amount of material on the outside diameter of the bearing until the bore has been completely machined. The bearing may then be mounted on a closely fitting arbor provided with lathe centers, so that when the outside diameter of the bearing is finished it will be exactly true and parallel with the bore.

Rather than make an entirely new bearing, it may be desired to rebabbitt the old shell. In such a case, the first operation is to melt out all the old babbitt, so as to provide a thoroughly clean interior surface for the new babbitt. Very often the shell will be of steel or cast iron. By following the correct method very carefully, it is possible to obtain just as good a bond of the babbitt to the steel surface as to the surface of a bronze bearing. This permits the use of a thin lining of babbitt, which is a distinct advantage in severe service. Usually it is impractical to form a solid bond with a cast-iron surface, and for this reason, the thickness of the babbitt must be considerable, in order to give me-

chanical strength to the lining, and anchor holes or grooves must be provided in the inner surface of the shell to give anchorage for the babbitt lining.

Obtaining a Good Bond Between Steel Shell and Babbitt

In obtaining a good bond between a steel shell and the babbitt lining the following points are essential:

1. A thoroughly clean and fluxed surface.
2. Careful tinning of the surface to be babbitted, preferably by submerging the shell in a pot of molten tinning alloy.
3. Correct temperature of the shell without oxidation of the surface. This is easily accomplished if the preferred method of tinning is carried out.
4. Good babbitt (tin-base alloy preferred), applied at the correct temperature with careful avoidance of overheating.
5. Correct temperature (same as shell) of mandrel for forming inside diameter (if used). The centrifugal method of casting the babbitt is preferred, in which case no mandrel is required.

After all the old babbitt is melted out, the shell can be cleaned by submerging it in a 10 per cent solution of commercial sulphuric acid (one part acid to ten parts water). The shell should remain in the solution for not less than fifteen minutes, until all rust and scale are removed. It is preferable to maintain the temperature of the solution between 60 and 80 degrees C. when in use.

Fig. 3. Pressing a Motor Bearing into a Bracket on an Arbor Press

Having cleaned the bearing and rinsed it in pure water, the surfaces to be babbitted must be fluxed, and all other surfaces must be coated with a mixture of graphite and water or fire-clay and water to prevent the molten alloy from adhering to them. The fluxing is done by thoroughly swabbing the surfaces to be babbitted with a saturated solution of zinc in hydrochloric (muriatic) acid.

The fluxed shell should then be submerged in a pot of wiping solder having a composition of approximately 35 per cent tin and 65 per cent lead, until it reaches the temperature of the molten alloy, which should be maintained between 410 and 460 degrees C., or until the alloy runs freely off the shell without solidifying when it is withdrawn from the pot. This should result in a thoroughly tinned surface wherever the fluxing was done. Care should be taken to see that no spots remain untinned on the surface to be babbitted. The surface thus tinned should be fluxed again, and the shell immersed a second time in the tin pot to remove the excess acid. Immediately after, the shell is placed in the babbitting fixture and the babbitt poured. If a mandrel is used to form the center hole in the bearing, it should previously have been coated, as described for the outside surface of the bearing shell, and heated to about the same temperature as the shell.

It is of no use to tin cast-iron bearing shells, as the babbitt cannot ordinarily be bonded to the cast-iron surface, due presumably to the presence of free graphite in the cast iron. In this case, anchors should be provided to hold the babbitt to the shell. The cast-iron bearing shells should be preheated to a temperature of from 250 to 300 degrees C. before babbitting, so that the babbitt will flow close to the surface and into the babbitt anchors before solidifying. This preheating also results in the shell and babbitt shrinking more or less uniformly, so that they will not separate in cooling.

If the bearing is "still cast" rather than centrifugally cast, either lead-base or tin-base babbitt will flow satisfactorily between the heated shell and mandrel and produce a very satisfactory bearing. The molten babbitt should be held at a temperature of between 460 and 490 degrees C., taking care not to exceed the upper limit. If the flame or heating element is applied directly to the pot containing the babbitt, the latter should be stirred continuously to avoid its being overheated. A melting pot using the double-boiler principle with lead in the part of the boiler next to the flame is preferred.

The bearing shell and mandrel should be arranged in a vertical position if possible. The babbitt should be poured in a steady stream, directly along the mandrel, from a self-skimming ladle until the space between the bearing shell and the mandrel is filled. A more elaborate and somewhat preferable method is to provide a babbitting fixture in which the molten babbitt rises into the shell from the bottom. The shell can be removed from the fixture after cooling has solidified the babbitt.

For the centrifugal method of casting, the shell is rotated with its axis horizontal. Lead-base bab-

bitt is not so successfully cast centrifugally as tin-base babbitt, because of the separation of the lighter alloying elements from the lead under the influence of centrifugal force. In using the centrifugal method, rotation of the shell should be continued long enough to permit the babbitt to congeal.

The bore of the bearing as cast should be from 1/16 to 3/16 inch smaller than the finished bore, depending on the size of the bearing and the method of casting the babbitt. Centrifugal casting will require a greater allowance for finishing than "still casting." In cutting out grooves, it is usually best to duplicate the size, position, and direction of those in the original bearing. Oil distributing grooves should terminate in the surface of the bearing rather than cut through to drain holes or grooves. All edges of oil distributing grooves, both where oil enters from the supply and where it feeds into the bearing clearance space, should be well rounded to facilitate the flow of oil.

A fine bored surface for the bearing is best, although reamed, broached, or burnished surfaces are sometimes used. In the case of split bearings, the edges of the babbitt at the split adjacent to the journal should be somewhat chamfered, so that with slight transverse displacement of the halves, there will be no sharp edges to shave the oil film from the journal.

Installing Replacement Bearings

Having completed the replacement bearing, it is necessary to use special care in reassembling, particularly as the shape of the shell may have become slightly distorted in the rebabbitting process, because of the heating and cooling. It is assumed that the bearing has been bored concentrically with the outside diameter of the shell as accurately as possible. However, when the bearing is pressed into place in the motor bracket or pedestal, the bearing bore may become slightly out of round, as the bracket bore forces the outside diameter of the bearing to resume its original shape. For this reason, as well as to minimize errors in alignment, it is desirable to take the finish cut in the bearing bore after it has been pressed in place.

Split bearings may spread in width slightly during the babbitting operation, so that when forced into place in their housings, the diameter of the bore at the split will be reduced, thus resulting in pinching of the journal. Additional chamfering or scraping of the babbitt may be necessary to offset this condition, unless the bearing can be finish-bored after assembly.

In ring-oiled bearings, the oil-ring slot naturally weakens the shell, so that in pressing non-split bearings into place, it is necessary that the entrance end of the bearing go in with little pressure, depending on the press fit of the opposite end to hold the bearing securely in place. An arbor press should always be used for pressing in these bearings. If absolutely necessary to drive them in, this should be done very carefully, using a washer of soft material against the end of the bearing and a sleeve or bar of approximately the outside diameter of the bearing to receive the blows.

After the bearing is in place and the machine reassembled, it should be run for a short time without load to check the alignment. This is particularly desirable if it has not been possible to take a finish cut in the bearing after assembly in the bracket. If, when the machine is subsequently disassembled, bright rubbed spots appear in the bore of the bearing, it will be necessary to scrape thin shavings of babbitt from these spots to eliminate the metal-to-metal contact. This check should be repeated a number of times to remove all high spots or relieve any misalignment.

Making Repairs when Castings are Broken

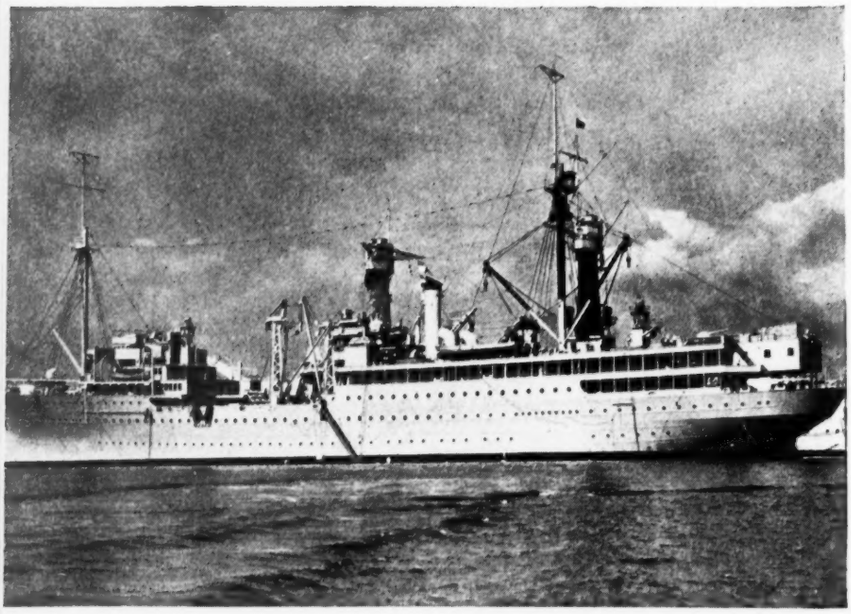
It sometimes happens through accident or abuse that a cast-iron part of a motor is broken, making the motor unfit for use. The welding on of a finished motor part, whether steel or cast iron, is almost certain to result in distortion and to throw the finished mating surfaces out of line, so that a repair of the broken part by welding in the ordinary manner may not be very successful. A serviceable repair can, however, be made in many cases by the following method without causing appreciable distortion.

Take, for example, the foot of a motor frame that has been fractured. The remaining portion of the fractured foot is machined to a smooth true surface, so that a piece of steel bar, plate, or structural steel shape can be used in making the repair. If the cast-iron section thus exposed is of sufficient thickness, it may be drilled and tapped to be a tight fit on two or more large steel studs. For convenience, bolts may be used, and most of the part protruding from the tapped hole after the bolt has been screwed in place may be cut off, allowing from 1/4 to 3/8 inch projecting above the surface. The fit of the bolt in the threaded hole should be so tight that it is necessary to use a wrench to screw it in from the entrance of the first thread.

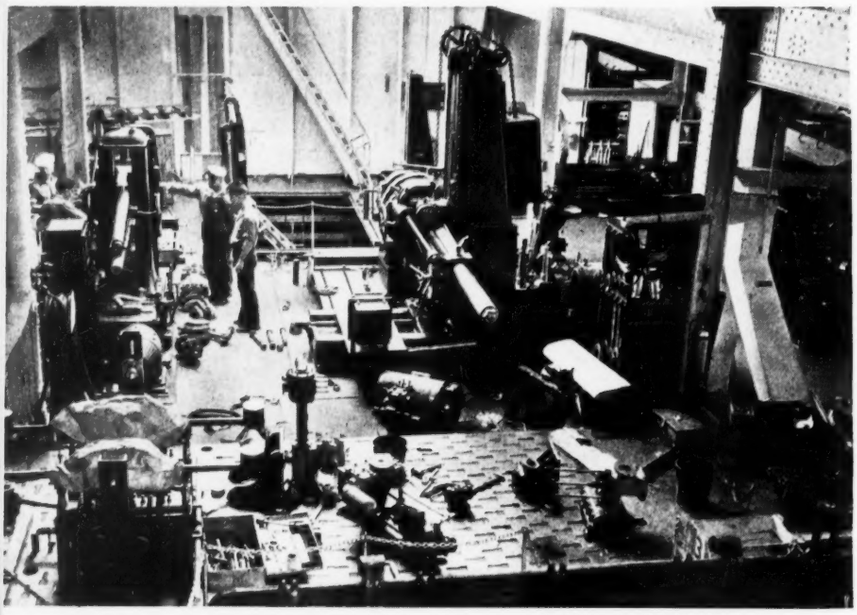
The block of steel that is to be used to replace the broken-off portion of the foot is then drilled with clearance holes to fit over the protruding part of the studs. With this block tightly clamped in place, the end of the steel studs is arc-welded to the surface of the bore of the holes in the block. Shrinking of the stud and weld when cooling tends to accentuate the tightness of the fit at the joint, so that a very strong and rigid attachment is made. Afterward, the steel block may be machined off to a surface which is uniform with the other feet of the motor, and finally the hole for the foundation bolt can be drilled.

The same principle can be employed in repairing cracked brackets. In such a case, however, the steel plate used will probably bridge the crack, and studs will be used in both parts of the casting adjacent to the crack, but no welding of the parent metal will take place, the welding being confined to the steel studs and steel plate.

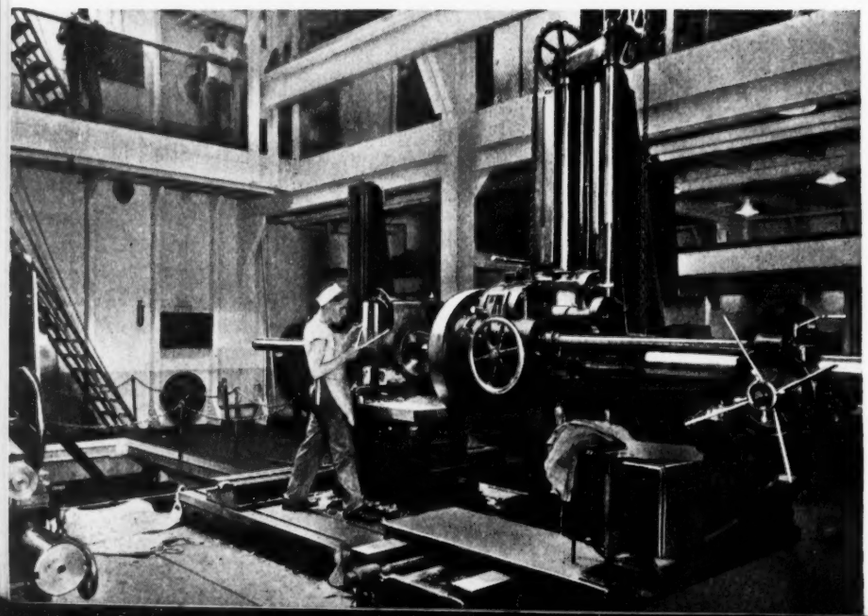
★ ★ Aboard One of the Navy's



Keeping Uncle Sam's War Vessels in Fighting Trim when They are away from the Facilities of the Navy Yards is the Mission of the U. S. S. Medusa, a Ship of 10,620 Tons Displacement, 484 Feet Long and 70-foot Beam. This Vessel Has a Rated Speed of 16 Knots an Hour

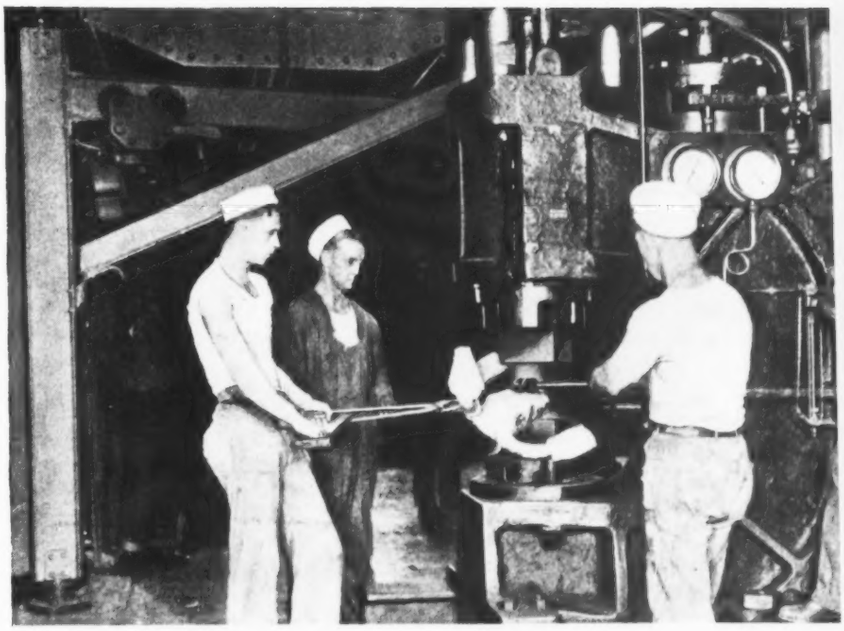


This General View of the Machine Shop on the Medusa Shows Two Horizontal Boring Mills, which, in Conjunction with Engine Lathes, Turret Lathes, Planers, Slotters, Milling Machines, and Drilling Machines, Enable the Machine Shop to Handle the Numerous Repair Jobs Assigned to it

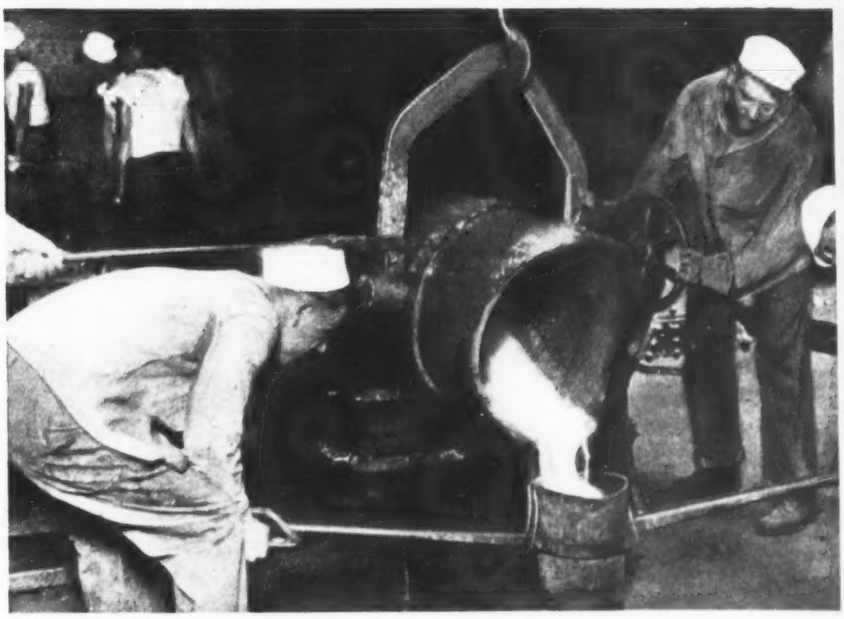


A Much Larger Boring Mill than One would Expect to See Aboard Ship is Here Shown Engaged in Finishing a Spare Bearing Brass. The Personnel of a Navy Repair Shop Necessarily Includes Skilled Machinists, Metalsmiths, Electricians, Molders, Pipe-fitters, and Other Craftsmen

Floating Repair Ships ★ ★



Hammering a Rather Complicated Forging to Shape in the Busy Forge Shop below Deck on the Medusa, which is Called upon to Supply the Emergency Demands of the Fleet without Recourse to the Dies that May have been Used in Producing the Original Forgings that Must be Replaced



Even Castings Must be Produced Aboard Navy Repair Ships to Meet Sudden Requirements, and so there Must be Furnaces Available for Smelting the Metals and Expert Foundrymen among the Personnel for Preparing the Molds and Supervising the Pouring of the Molten Metal

Chronometers, Range-finders, Sextants and Dozens of Other Fine Instruments that are Required for the Navigation of War Vessels and for the Accurate Control of Their Fighting Equipment, are Kept in Dependable Working Order by These Instrument-makers in a Corner of the Optical Shop

Machine Tool Builders Discuss Pressing Problems

AT the meeting of the National Machine Tool Builders' Association, held at the Edgewater Beach Hotel, Chicago, Ill., April 24 and 25, a great number of the important problems of the industry were given serious consideration. The president of the Association, Wendell E. Whipp, president of the Monarch Machine Tool Co., Sidney, Ohio, in his opening address, entitled "Change Brings Opportunity," touched upon many of these problems, and suggested some lines of procedure in their solution.

Wendell E. Whipp, President of National Machine Tool Builders' Association

He pointed, first, to the mechanical and engineering changes that have taken place, and are constantly occurring, in industry, and showed how the machine tool builder has met the problems created by these changes with the kind of equipment necessary for new and refined methods and processes. He then proceeded to point out how there have also been other changes that have been prompted, "not," as he said, "by our own wish, but by forces entirely outside of our control. These changes have been so widespread and so fundamental as to affect us at every point.

"There have been fundamental changes in the national thinking of the American citizen. When we were youngsters, we had copy books in which we practiced painfully the art of writing clearly and legibly, and in those copy books we had certain maxims that were supposed to reflect the higher standards of life that we should adopt as a part of our own character. One of these was 'A penny saved is a penny earned.' The basic idea was that a man has his destiny largely in his own hands, and that security for the future must come from a man's own determined policy of saving part of his earnings and investing them in a thrifty way.

"All this has been changed. This burden of saving has now been voluntarily assumed by the National Government and no longer rests on the individual. He need no longer worry about his future; for a beneficent Government assures him of at least a living income. But the Government that has assumed this responsibility has only one source of income—taxes. Taxes must be paid by those who are producing and who are earning. To be quite accurate, this burden has not been assumed by the Government, but by those who are producing. Those who are working must support those who are idle.

"At the same time, as a nation, we have largely dammed back the source of new capital that should replenish our going enterprises, and are draining industry through heavy taxes, so as greatly to reduce that employment which, in the last instance, must meet these heavier tax burdens. I have in mind a large oil company that, in 1938, paid $3400 in taxes for each employe on its payroll. Its total tax bill is, of course, far higher than the total payroll. After paying taxes of $22.80 for each share of common stock, it had $1.80 per share left as 'earnings.'

"To say that there is sure to be further change in this attitude toward thrift is merely to express my very deep confidence in the good sense of the American people. Indeed, recent discussions by high officials in Washington reflect the altered viewpoint that must be adopted. To those of us who daily live with the problem of excessive tax burdens on industry, the change seems inevitable, and we hope it will not be long delayed.

"It will bring as an immediate consequence new investment funds to rebuild our depleted capital structure—these dollars being spent in taxes can then be put into better manufacturing equipment in every industrial field. More employment at good wages will be the inevitable result.

"So much for the rehabilitation of our present industrial structure. What can we say of new enterprises? The fact is that we have, as a nation, discouraged the formation of such companies. Should a man plan to start a new manufacturing unit, we practically say to him: 'We are going to make it just as difficult as possible for you to secure the money you need by selling stock in the market. To those of your friends who might be inclined to risk their money in your new venture, we will present a picture of such uncertainty in the Government attitude toward business in general that they will be inclined to keep their money rather than to risk it.

" 'We will encourage high wage-rates and shorter hours, so as to make your manufacturing operations as expensive as possible, and we will look the other way when union policies call for the limitation of output. In fact, so far as labor is concerned, we

will place all of the burdens we possibly can on the shoulders of management, and make it extremely difficult for you to build up an organization of shop executives and foremen who have the skill required to handle the complex problems involved. In all of your labor problems, the inference by Government agencies will always be that you are unfair and untrustworthy.

" 'We will place upon your new enterprise legal restrictions so complex and so varied that you will require an expert in your organization to fill out dozens and dozens of returns, questionnaires, and blanks, and to advise you on the frequent complications you will encounter, and to help you secure rulings on the points that legislation has not made clear.

" 'We will drain the earnings out of your business with taxes on the income of the corporation, so that these earnings cannot be plowed back in order to safeguard the business against the depressions of the future, or in order to expand its operations, or in order to reduce its manufacturing costs, so as to partially offset the high labor costs that will result.

" 'If you succeed in spite of this, we will view you with suspicion; and you may be subjected to public scorn, for it is our understanding as a nation today that when a corporation grows and is successful, there must be something wrong with it somewhere.'

"In other words, we practically dare a man to go into business for himself. Grim as this outlook is at the moment, there are signs of change that reflect a new understanding."

One of the subjects that was given especial attention at the meeting was "Industrial Education." A report on this subject was presented by E. C. Stubbs, works manager of the Fellows Gear Shaper Co., Springfield, Vt., and chairman of the Association's Committee on Industrial Education. He emphasized that one of the major problems of the metal-working industries has always been that of educating skilled mechanics to make practical the engineer's dreams and inventions. The complexity of engineering development in industry today calls for greater mechanical skill than ever before.

Mr. Stubbs reviewed briefly the conditions now existing in industry with regard to the need for skilled men and the extent of apprentice training, and then called attention to the various cooperative apprentice courses that have been so successful in many localities, where the public high schools work hand in hand with the manufacturers to furnish a general and a trade education simultaneously. A plea was made for a planned continuous form of apprentice training that would not be in operation only when industry found itself extremely active, but that would educate skilled workers in advance of such activity, so that they could take their proper places in industry when most needed. An apprentice program has little value if it operates only in times of prosperity.

Another subject of importance to the entire industry was presented to the meeting by B. P. Graves, director of design of the Brown & Sharpe Mfg. Co., Providence, R. I., who discussed "Electric Motor and Control Application to Machine Tools." Mr. Graves is chairman of the Association's Committee on Electrical Problems.

Among the many other interesting addresses and papers presented before the meeting, two very timely ones were that by Carlton Ward, Jr., general manager of the Pratt & Whitney Division of the United Aircraft Corporation, on "Airplane Engines of the Future," and that by Charles J. Stilwell, vice-president and general manager of the Warner & Swasey Co., entitled "Planning for the Emergency."

The subject of foreign trade in machine shop equipment was dealt with in two papers—one by John Abbink of the McGraw-Hill Publishing Co., on "New Markets in South America," and one by Russell T. Kelley, president of Russell T. Kelley, Ltd., Hamilton, Ontario, on the subject "Canada—1939."

The problems of industry from the governmental point of view were dealt with by William E. Kelly, president of the Machinery and Allied Products Institute, in an address on "The Shifting National Scene."

* * *

Why the Railroads are Unable to Recover

According to the *Railway Age*, the tax collectors took $341,000,000, from the railroads last year, while the owners of the railroads operated them at a loss of $123,000,000. In fact, the total net income earned by the railroads in the last eight years has been only $120,000,000; during the same period, the railroads have paid to federal, state and local governments, $2,291,000,000 in taxes, or approximately nineteen times the total net income for the same period of years. To put this more simply, for every dollar paid in taxes, about a nickel was earned in net income. No wonder the railroads are unable to recover!

That the tax burden placed on the railroads is unreasonable is quite generally admitted. An interesting example of how the railroads help to pay the general expenses of the counties through which they pass is given in a recent issue of *Railroad Data*. In 1938, the railroads paid in taxes to Woodford County, Kentucky, for the county's general expenses, maintenance of highways, and the support of public schools, the sum of $75,121. A leading bus line's county tax bill was $56. A company that operates a line of freight trucks through the county paid $4 in county taxes.

* * *

According to a statement made by the Automobile Manufacturers Association, about half as much rubber is required for other uses in an automobile as is molded into the tires.

Trends in Machine Tool Design as

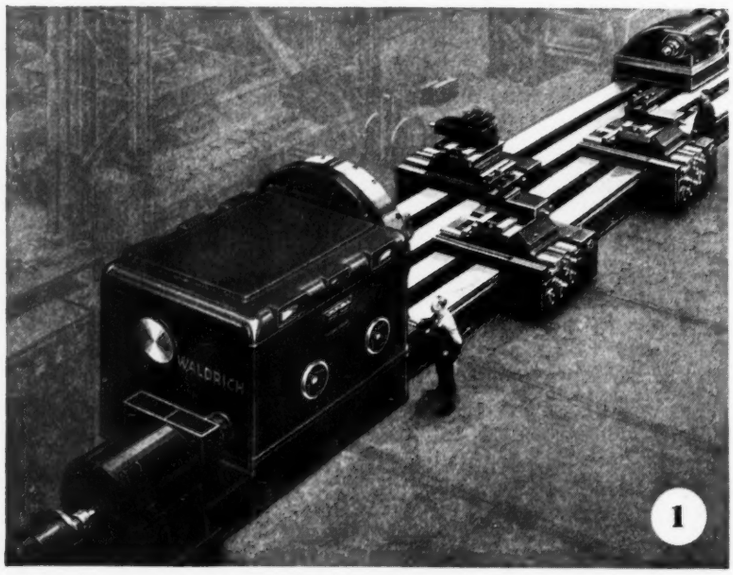


Fig. 1. A Huge Lathe Exhibited by the Waldrich Werkzeugmaschinenfabrik. This Machine Has a 7-foot Swing, the Distance between Centers is Over 26 Feet, and it will Accommodate Work up to 100 Tons in Weight. The Machine Itself Weighs 130 Tons, and is Provided with a 150-H.P. Motor

Fig. 2. Another Giant Machine, Exhibited by Schiess-Defries A.G. This Machine is Built for Milling the Slots in Large Turbo-electric Rotors. It will Accommodate Work up to 7 1/2 Feet in Diameter, 28 Feet Long, and Weighing up to 175 Tons. The Machine is of the Duplex Type, with a Complete Milling Machine Mounted on Each Side of the Rotor being Operated on. Separate Motors are Used for Practically All Motions. The Machine Weighs 170 Tons

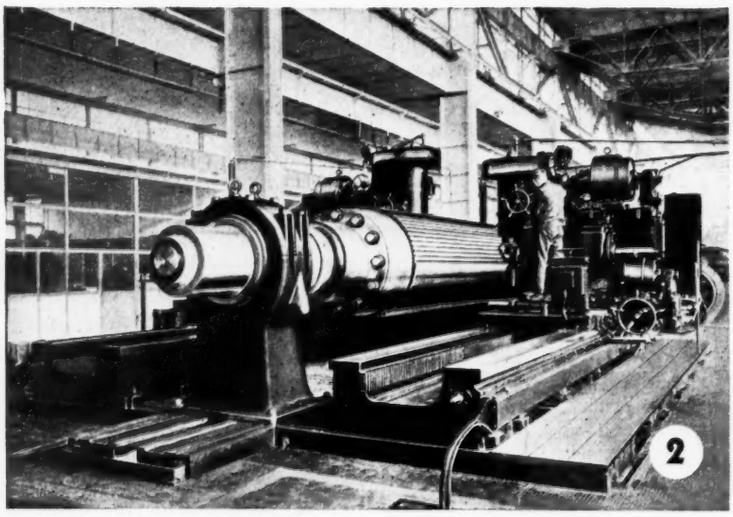
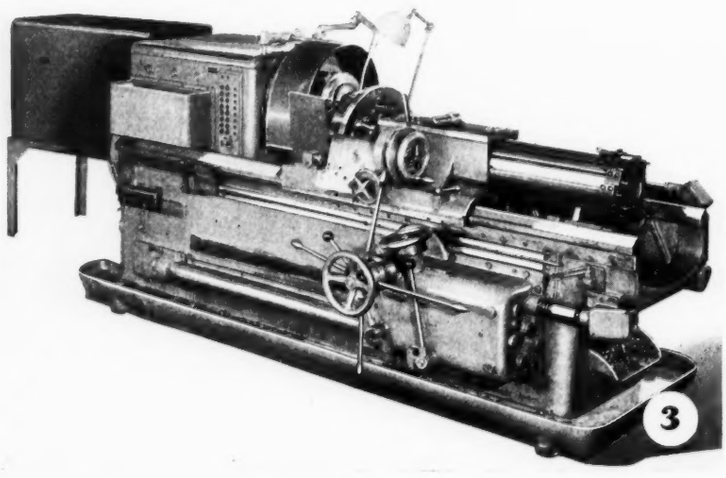
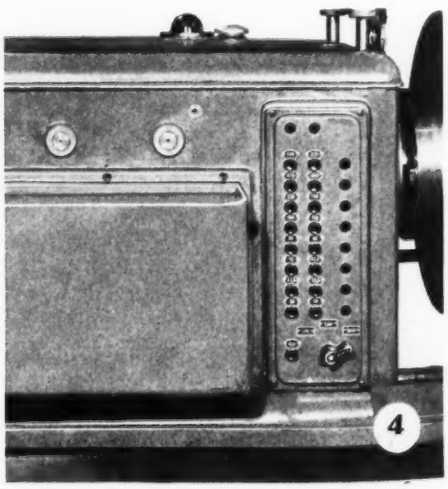


Fig. 3. A Newly Designed Pittler Turret Lathe Having a Turret with a Horizontal Axis, a Characteristic of Pittler Design, which in This Respect is Quite Different from the Usual American Practice

Fig. 4. A Close-up View of the Push-button Speed-changing Arrangement on the Pittler Turret Lathe Seen in Fig. 3, by Means of which Any Available Spindle Speed is Instantly Obtained through a Mechanism Actuated by a Small Electric Motor





Noted at the Recent Leipzig Fair—1

Fig. 5. A Reinecker Universal Gear-Hobbing Machine of Improved Design, Adapted for Cutting Spur, Helical, and Worm Gears. This Machine Has a Capacity for Gears up to 5 Feet in Diameter and 2 Diametral Pitch

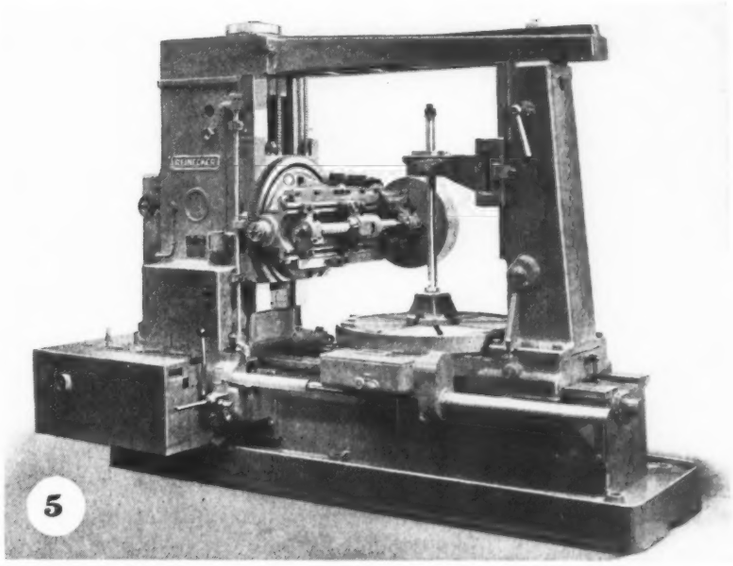


Fig. 6. Camshaft Grinding Machine Designed by Fritz Werner A.G. Especially for the Aircraft Industry. As will be Noted, This Design of Camshaft Grinding Machine is a Radical Departure from Conventional Design

Fig. 7. Bench Drilling Machine Built by the Loewe-Fabriken. The Speed-changing Arrangement Used Permits Any Speed from 235 to 8500 R.P.M. to be Obtained, Making the Machine Suitable Both for Ferrous Materials Drilled at Comparatively Low Speed and Non-ferrous Materials Drilled at High Speed. A Chart on the Front of the Head Shows at a Glance Corresponding Hole Diameters, Cutting Speed, and Revolutions per Minute. The Required Speed can be Instantly Obtained by a Speed Controller Moving over a Scale

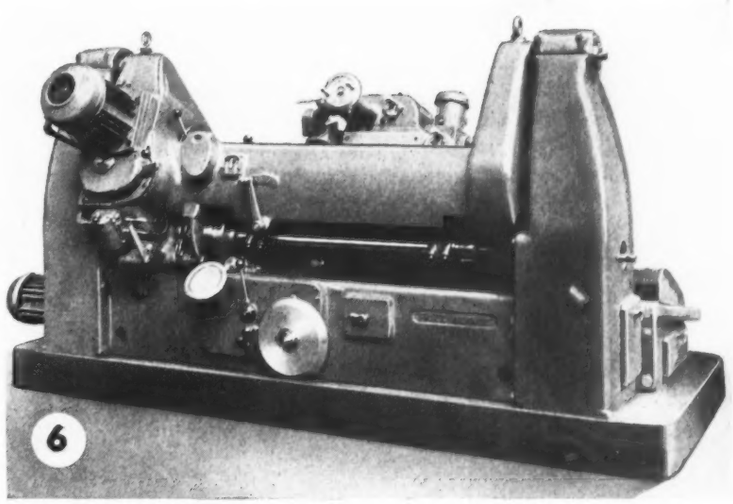
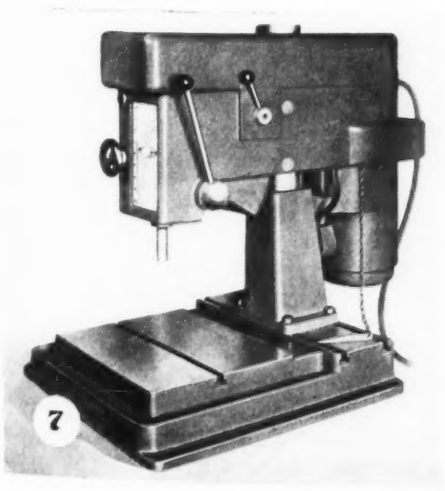
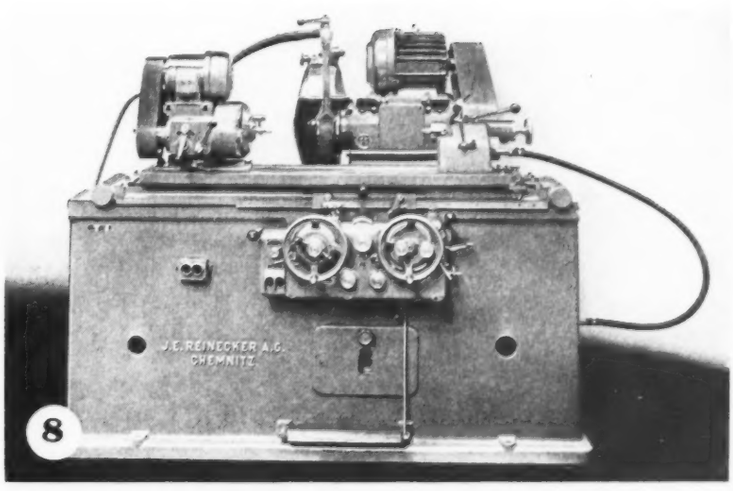
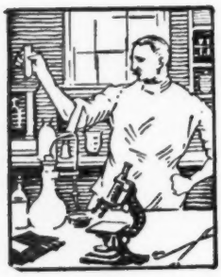


Fig. 8. Reinecker Cylindrical Grinding Machine for Work 10 by 40 Inches, Provided with Hydraulic Table Movement, Hydraulic Quick Adjustment and Plunge-cut Motion of Grinding Wheel, and Hydraulic Withdrawal of Tailstock Center





MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Forging Steel with Unusual Strength in Normalized and Tempered Condition

A forging steel that has unusual strength in the normalized and tempered condition is a recent development of the Vanadium Corporation of America, New York City. This steel, which has a potentially wide application in making both light and heavy forgings, is a low-carbon manganese-molybdenum-vanadium alloy of the following composition: Carbon, 0.26 to 0.33 per cent; manganese, 1.35 to 1.65 per cent; molybdenum, 0.20 to 0.30 per cent; vanadium, 0.10 to 0.15 per cent; phosphorus, maximum 0.05 per cent; and sulphur, maximum 0.05 per cent.

Normalized and tempered specimens 2 1/4 inches in diameter have shown a yield point of 106,150 pounds per square inch, a tensile strength of 119,400 pounds per square inch, 20.5 per cent elongation in 2 inches, and a reduction in area of 62 per cent. Specimens 9 inches in diameter have shown a yield point of 89,400 pounds per square inch, a tensile strength of 103,900 pounds per square inch, an elongation of 21 per cent in 2 inches, and a reduction in area of 61.8 per cent. Still greater strength and corresponding improvement in other properties are obtainable by quenching and tempering; and, because of the low range of carbon content, water can be used as the quenching medium, particularly for small and medium sections. 201

Coating for Reducing Wear of Machine Parts

A coating material known as Thermoil-Granodine has been developed by the American Chemical Paint Co. of Ambler, Pa., for preventing wear and rust of machine parts. The procedure in applying this coating consists mainly of immersing the machine parts, after they have been thoroughly cleaned, in a boiling solution of Thermoil-Granodine. The solution reacts with the machine part and transforms its surface into a layer of iron and manganese phosphates which become an integral part of the metal beneath.

When a surface treated in this manner is oiled and used as a bearing surface, it quickly becomes burnished. Automobile engine parts, such as pistons, camshafts, valves, and gears are particularly suitable for treatment by this process. 202

Transparent Coating to Protect Metal from Weather

A transparent protective metal coating that is said to withstand the action of sunlight, moisture, and climatic changes has been placed on the market by the Fales Chemical Co., 545 Fifth Ave., New York City. This coating, which is known as "Seal-Cote," has been used successfully with copper, brass, bronze, steel, and other metals, and is said to have preserved their original finish when exposed to weather for periods of at least six months. The coating may be spread or brushed on metal surfaces. 203

Kennametal Inserts for Increasing the Life of Stamping Dies

Inserts of a hard carbide for dies used in stamping and drawing automobile parts, chair casters, electrical appliances, and many other metal products have been developed by the McKenna Metals Co., 147 Lloyd Ave., Latrobe, Pa. The manufacturer states that, in regular production runs, dies provided with these Kennametal inserts have stamped out 70,000 chair casters before the first regrind, as compared with a total life of 14,000 pieces for the tool steel dies previously used. In addition, the Kennametal-faced dies can be reground several times before discarding is necessary.

In the form of cutting tool tips, Kennametal is said to possess the ability to machine steel having a hardness of up to 500 Brinell, and to combine roughing and finishing in one operation. Eighteen styles of Kennametal-tipped tools are available, as well as three standard styles of blanks for concerns that make a practice of brazing their own tools. Special blanks can also be supplied. 204

To obtain additional information about materials described on this page, see lower part of page 656.

Stainless Steel Helps to Beautify the New York World's Fair

Practically all the buildings at the New York World's Fair use stainless steel in one form or another for beauty and strength. At the theme center of the Fair is a futuristic gang-plank known as the "Helicline," which is 18 feet wide and encircles the Perisphere. It is approximately 900 feet long and is faced with brushed stainless-steel sheets. Located in the Court of Peace is a flag pole 150 feet high which rises from a base of stainless steel that is 30 feet square.

What is believed to be the world's largest weather vane marks the American Radiator and Sanitary Administration Building. This weather vane rises to a height of 72 feet and is constructed entirely of stainless steel. In the Court of Medicine, is a modernistic spiral-cone water fountain constructed of stainless steel that rises 50 feet in the air.....205

Metal Coatings That Prevent Adhesion of Weld-Spatter

Two metal coatings, known as "Flash-Ex" and "Spatter-Ex," have been brought out by the Wayne Chemical Products Co., Detroit, Mich., to eliminate the necessity of grinding or chipping weld-spatter from the metal surrounding a weld. Both compounds are soluble in water. They prevent the adhesion of spatter to the part, dies, or welding-holder jaws. After the welding operations have been completed, any spatter on the surrounding flat surfaces is merely brushed off.

The "Spatter-Ex" compound is a transparent jelly-like coating, and is effective in either arc, flash, or butt welding. The "Flash-Ex" compound, which is white and pigmented, is largely used in resistance welding to prevent the dies and welding-holder jaws from becoming jammed with spatter.....206

Plates of Nickel-Clad Steel Nearly Thirteen Feet Square

The widest plates of nickel-clad steel ever rolled were recently produced by the Lukens Steel Co., Coatesville, Pa., on its 206-inch plate-rolling mill. Two plates were produced, each measuring 152 inches long by 151 inches wide by 3/4 inch thick and weighing 5315 pounds. The nickel-cladding on one surface of each plate consisted of 10 per cent of the total plate thickness or 0.075 inch.

The two plates were supplied to a chemical company for forming the shell of a vessel 8 feet outside diameter by 15 feet 11 inches high. Because of the width of the sheets, only two longitudinal joints were required in making the shell, and no circumferential joints were necessary, except at each end, where the heads are joined to the shell.207

Meehanite Cast Iron Used for Truck Trailer Brake-Drums

Cooperative research under the auspices of the Meehanite Research Institute, Pittsburgh, Pa., and the General Foundry & Mfg. Co., Flint, Mich., has led to the adoption of brake-drums made of Meehanite cast iron for the heavy-duty truck trailers used by the Fruehauf Trailer Corporation, Detroit, Mich. These drums range in diameter from 18 to 19 1/2 inches, and weigh from 80 to 115 pounds. Ribs or fins are cast on the outside of the drums to assist in dissipating the heat. Meehanite iron has been found especially suitable for these brake-drums because the metal finishes to a mirror-like surface that does not gall under severe use.....208

Dowmetal Used in Constructing Portable Conveyors

Terminals of the Railway Express Agency all over the country are being supplied with portable gravity type conveyors constructed of Dowmetal because of its light weight. These magnesium-alloy conveyors, which are made in 10- and 13-foot lengths, can be readily carried by one man to incoming trucks, baggage cars, etc., for conveniently loading and unloading express matter. The extruded siderail channels, the rollers, and even the through shafts are made from Dowmetal. More than one-half mile of these conveyors have already been placed in operation.....209

Gravity Conveyors Constructed Entirely of Dowmetal Expedite the Loading and Unloading of Express Matter

To obtain additional information about materials described on this page, see lower part of page 656.

NEW TRADE LITERATURE

Haynes Stellite Alloys

HAYNES STELLITE CO., UNIT OF UNION CARBIDE AND CARBON CORPORATION, 205 E. 42nd St., New York City. Booklet containing tables giving physical, mechanical, and chemical properties of Haynes Stellite, Haystellite, Hascrome, and Hastelloy, and other information of value to engineers and those who design equipment parts that must withstand wear, abrasion, impact, or chemical corrosion. 1

Broaching Machines

CONTINENTAL TOOL WORKS DIVISION OF EX-CELL-O CORPORATION, 1212 Oakman Blvd., Detroit, Mich. Bulletin 12791, entitled "Problems Solved by Broaching," showing actual examples that indicate the widening field of broaching, and giving the improvements made in machining time, limits, and finish, as compared with other methods. 2

Screwdrivers and Bits

APEX MACHINE & TOOL CO., Dayton, Ohio. Catalogue of Apex-Phillips screwdrivers and bits for electric, air, and spiral drivers; designed to supply tool supervisors, production engineers, master mechanics, and purchasing agents with detailed information regarding drivers for Phillips recessed-head screws and slotted-head screws. 3

Universal Joints and Flexible Drive-Shafts

MECHANICS UNIVERSAL JOINT DIVISION OF BORG-WARNER CORPORATION, Rockford, Ill. Catalogue showing industrial applications of this company's line of roller-bearing universal joints and flexible drive-shafts. Engineering data of value to designers is included. 4

Taps

JOHN BATH & CO., INC., Worcester, Mass. Instructive and entertaining pamphlet on tapping, containing practical information regarding the uses and selection of the correct taps and the proper machine condition for threading different types of material, cleverly illustrated by humorous cartoons. 5

Recent Publications on Machine Shop Equipment, Unit Parts and Materials. To Obtain Copies, Check on Form at Bottom of Page 655 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in May Number of MACHINERY

Hardening Equipment

LEEDS & NORTHRUP CO., 4921 Stenton Ave., Philadelphia, Pa. Circular entitled "Making Good Parts Better with Vapocarb-Hump Hardening," describing the improvement in quality of rollers and header blocks for cold-heading machines obtained by the use of the Vapocarb-Hump system. 6

Electrical Equipment

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Instruction Leaflet 2806, on the use and care of the Type L-33 electrical interlock for alternating current. Descriptive Data 11-200, on non-reversing line-starters for squirrel-cage and wound-rotor motors. 7

Gear-Cutting Tools

MICHIGAN TOOL CO., 7171 E. McNichols Road, Detroit, Mich. Booklet containing data of value to users of gear-cutting tools, including information on selecting the right hob for the job; estimating roughing time; hob sharpening; hob limits; tables of cutting speeds, etc. 8

Speed Reducers

W. A. JONES FOUNDRY & MACHINE CO., 4409 Roosevelt Road, Chicago, Ill. Catalogue on Jones herringbone gear speed reducers, illustrating their wide range of application and giving information on how to select reducers for various conditions of service, in accordance with A G M A recommended practice. 9

Wear Testing Equipment

TABER INSTRUMENT CO., North Tonawanda, N. Y. Bulletin 3901, describing the Taber abraser, a portable precision wear tester for determining the amount of wear that painted or lacquered surfaces and other applied finishes will withstand. 10

Automatic Composition Applicator for Buffing Wheels

HAMMOND MACHINERY BUILDERS, INC., 1619 Douglas Ave., Kalamazoo, Mich. Circular describing the new Hammond "Auto-Doper," which applies composition automatically to buffing wheels of polishing machines. 11

Bushing Threading Machines

POTTSTOWN MACHINE CO., Pottstown, Pa. Circular illustrating and describing reversing-spindle machines designed especially for threading and tapping fittings and bushings without preliminary machining. Ratings, dimensions, speeds, and outputs are given. 12

Four-in-One Tool-Room Machines

GILMAN ENGINEERING WORKS, Janesville, Wis. Bulletin describing the Gilman 4-in-1 tool-room machine, which takes the place of a precision lathe, a sensitive drill, a horizontal milling machine, and a vertical milling machine. 13

Texrope Vari-Pitch Sheaves

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis. Bulletin 1261B, illustrating and describing stationary control vari-pitch sheaves for occasional changes of speed, and the motion control type for frequent speed changes. 14

Conveyors

MATHEWS CONVEYER CO., 212 Tenth St., Ellwood City, Pa. Catalogue HB-39, containing 384 pages (pocket size) of engineering data on the conveyors made by this concern. Available to engineers and plant operating men only. 15

Forging Hammers

AJAX MFG. CO., Cleveland, Ohio. Bulletin 120, descriptive of the Ajax

"Rodrop" hammer, a new type of forging hammer designed to meet the need for a fast, flexible, and powerful machine that is inexpensive to operate. 16

Hydraulic Turning Machines

LANDIS MACHINE CO., INC., Waynesboro, Pa. First of a series of circulars to be published bi-monthly under the title "Thread Tips," describing the "Lanhydro" hydraulically operated turning machine for rapid production. 17

Arc-Welders

WESTINGHOUSE ELECTRIC & MFG. Co., East Pittsburgh, Pa. Leaflet 26-320, on the Midget Marvel Flexarc alternating-current welder, a low-priced welder for all-around maintenance and shop work, as well as light construction work. 18

Flexible Couplings

LOVEJOY FLEXIBLE COUPLING CO., 5009 W. Lake St., Chicago, Ill. Catalogue illustrating the construction of the L-R flexible couplings by means of line drawings, as well as halftones. Complete specifications are included. 19

Cutting Coolant

E. F. HOUGHTON & Co., Third, American, and Somerset Sts., Philadelphia, Pa. Circular describing Cut-Max Base No. 7, a new cutting coolant for use in machining all carbon and alloy steels. 20

Hydraulic Cylinders

HANNA ENGINEERING WORKS, 1765 Elston Ave., Chicago, Ill. Catalogue 229, containing information on a complete line of high-pressure hydraulic cylinders, intended to assist those considering the use of such equipment for various purposes. 21

Phosphor-Bronze

RIVERSIDE METAL CO., Riverside, N. J. Catalogue covering the composition, properties, and applications of phosphor-bronze; also gives chemical composition and temper requirements of different grades made by the company. 22

Safety Goggles

MINE SAFETY APPLIANCES CO., Braddock, Thomas, and Meade Sts., Pittsburgh, Pa. Leaflet descriptive of the M.S.A. "Speedframe," a new design of goggles for welders, intended to eliminate waste motion in adjusting. 23

Machine Tools and Precision Measuring Tools

GEORGE SCHERR CO., 128 Lafayette St., New York City. General catalogue showing the complete line of machine tools and precision measuring tools handled by the organization. 24

Variable-Speed Transmission

IDEAL COMMUTATOR DRESSER CO., Sycamore, Ill. Circular descriptive of the Ideal "Select-O-Speed" transmission, made in two types with standard lever control and with handwheel control for finer speed adjustments. 25

Indicating and Control Instruments

WHEELCO INSTRUMENTS CO., 1929 S. Halsted St., Chicago, Ill. Bulletin 3200, descriptive of the Wheelco potentiometer controller. Bulletin 4100, on the new Wheelco dial-indicating thermometer. 26

Presses and Shears

NIAGARA MACHINE & TOOL WORKS, 637 Northland Ave., Buffalo, N. Y. Circular containing pictorial representation of the complete line of latest type Niagara presses and shears, with brief description. 27

Milling Cutters

SEVERENCE TOOL MFG. CO., 1532 E. Genesee Ave., Saginaw, Mich. Bulletin 12-T, illustrating and describing Severence cutters for burring, reaming, or facing tubing, and Midget milling cutters. 28

Burring Tools

STOW MFG. CO., INC., Binghamton, N. Y. Supplement to catalogue on Stow standard flexible shafts and equipment, illustrating a few of the many different shapes and sizes of burring tools made for use with this equipment. 29

To Obtain Copies of New Trade Literature

listed on pages 654-656 (without charge or obligation), mark with X in the squares below, the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail to:

MACHINERY, 148 Lafayette St., New York, N. Y.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46

Name ..... *Position or Title* .....

[This service is for those in charge of shop or engineering work.]

Firm .....

Business Address .....

City ..... *State* .....

[SEE OTHER SIDE]

Die Steels

CRUCIBLE STEEL CO. OF AMERICA, 405 Lexington Ave., New York City. Circular on high-carbon, high-chromium die steels, containing working instructions and other helpful information for die steel users. 30

Turret Lathes

BARDONS & OLIVER, INC., 1133 W. 9th St., Cleveland, Ohio. Catalogue illustrating and describing Bardons & Oliver Nos. 5 and 7 universal turret lathes with new single-lever spindle speed pre-selector. 31

Arc Welding Machines

HOBART BROS. CO., Hobart Square, Troy, Ohio. Circular entitled "A Trip Through the Most Modern Arc Welder Factory in the World," illustrating the equipment used in making Hobart arc welders. 32

Hydraulic Automatic Control for Variable-Speed Transmission

REEVES PULLEY CO., Columbus, Ind. Circular announcing a new type of hydraulic automatic control for the Reeves variable-speed transmission. 33

Lubricating Systems

BOWEN PRODUCTS CORPORATION, Auburn, N. Y. Catalogue 76, descriptive of the Bowen electric automatic lubricating system for application to machines, either individually or in a group. 34

Lathes

SEBASTIAN LATHE CO., Cincinnati, Ohio. Catalogue illustrating and describing the new Sebastian high-speed 12-inch lathe, suitable for machining aluminum, bronze, and similar metals. 35

Precision Dial Indicators

B. C. AMES CO., Waltham, Mass. Circular describing four new dial indicators which are sensitive to 0.000010 inch and accurate to 0.000025 inch. 36

Riveting Machines

TOMKINS-JOHNSON CO., Jackson, Mich. Bulletin R-1A, illustrating and describing the application of the "Rivitor" in the aircraft industry, as well as in other industries. 37

Rust-Resisting Base for Paint

PARKER RUSTPROOF CO., Detroit, Mich. Catalogue descriptive of the Bonderizing process for producing a rust-resisting base for paint finishes on iron, steel, or zinc surfaces. 38

New and Used Machine Tools

J. L. LUCAS & SON, INC., 3 Fox St., Bridgeport, Conn. Bulletin 101S, listing the automatic screw machines and headers of various makes available through this concern. 39

Portable Tools

ROTOR TOOL CO., Cleveland, Ohio. Circular containing facts and figures on the savings possible by the use of modern portable tools. 40

Wheels for Grinding Cemented Carbides

NORTON CO., Worcester, Mass. Folder briefly describing two new outstanding diamond wheels for grinding cemented carbides. 41

Monel Alloys

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York City. Bulletin T-5, containing information on the engineering properties of Monel. 42

Hydraulic Turbines

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis. Folder showing operations in producing hydraulic turbines for Boulder Dam. 43

Self-Lubricating Bearings

BOUND BROOK OIL-LESS BEARING CO., Bound Brook, N. J. Circular on "Nigrum"-impregnated hard wood self-lubricating bearings. 44

Vibrating Screens

PRODUCTIVE EQUIPMENT CORPORATION, 4600 S. Kedzie Ave., Chicago, Ill. Bulletin 239, on Selectro vibrating screens. 45

Motor Pulleys

LEWELLEN MFG. CO., Columbus, Ind. Catalogue 40, descriptive of Lewellen variable-speed motor pulleys. 46

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 657-669 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment mark with X in the squares below, the identifying number found at the end of each description on pages 657-669—or write directly to the manufacturer, mentioning machine as described in May MACHINERY.

51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 652-653, mark with X in the squares below, the identifying number found at end of each description on pages 652-653—or write directly to the manufacturer, mentioning name of material as described in May MACHINERY.

201	202	203	204	205	206	207	208	209

Fill in your name and address on other side of this blank.

Detach and mail to MACHINERY, 148 Lafayette St., New York, N. Y.

[SEE OTHER SIDE]

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

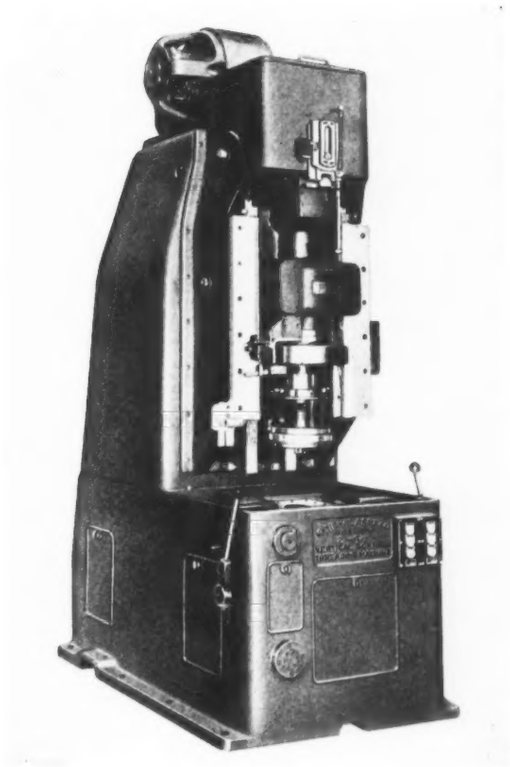


Fig. 1. National Acme Coupling Boring and Threading Machine

National Acme Vertical Boring and Threading Machines

The National Acme Co., 170 E. 131st St., Cleveland, Ohio, has brought out a Model VT vertical boring and threading machine in three sizes, having maximum chuck capacities corresponding to 4 1/2-, 8 5/8- and 13 3/8-inch A.P.I. sizes. This new machine is designed especially for the precision-threading or finish-boring of couplings to A.P.I. standards as required for high-pressure work in the oil industry.

Unlike previous machines, in which the tapping operations are performed with rigidly held tools and floating chucks, this new hydraulically and mechanically operated machine has a work-holding chuck mounted in an indexing plate which is held rigid, while the tap floats vertically. After one end of the coupling has been threaded, the chuck is indexed 180 degrees and the operation is repeated in the opposite end. Since the chuck jaws are not released from the work between the two tapping operations, the taper bores and threads produced at both ends of one coupling are always in accurate alignment.

The operating cycle in tapping both ends of a coupling is as follows: Movement of a lever causes the chuck to open and a work-locating gage to swing under the chuck. After the coupling has been placed in the chuck, the lever is moved again, causing the chuck to close, the gage stop to swing clear of the chuck, and the work-discharge door to close. Next, another lever is moved which causes the tap to descend to the face of the coupling under rapid hydraulic traverse and stop. The lead-screw then engages, causing the tap to enter the coupling, cut to the required length and collapse. The lead-screw now disengages, the spindle head is traversed rapidly upward, the tap reset at the top of the stroke, and the chuck indexed ready for tapping the other end of the coupling. Rapid traverse and lead-screw control of the spindle head are then repeated.

When both ends of a coupling have been tapped, the spindle head stops on the up stroke. The operator then pushes the control lever again, causing the chuck jaws to release and the threaded coupling to drop out, thus completing the cycle. The vertical door back of the chuck swings forward and automatically guides the finished coupling to a conveyor for delivery at the rear of the machine.

The heavy plate that carries the work-holding chuck is mounted in trunnion bearings, the rapid indexing movement being obtained by a hydraulic motor and an automatically controlled locking bolt which is seated without shock. The change-gears which control the lead-screw travel for different pitches require the changing of only one gear for each pitch. The main-drive variable-speed motor may be mounted either on the top or on the rear of the machine. The hydraulically operated lead-screw and split-nut mechanism provides for precise timing of the engagement and release of both segments of the split nut at the root of the lead-screw thread. At no time is the lead-screw used for rapid traverse. A lead-screw compensator device is provided, by means of which the operator can make quick adjustments, so that operation under changing temperatures and other conditions will not affect the accuracy of the thread produced.

Start, stop, and jog control buttons are provided for both the drive motor and the hydraulic pump motor. Three additional cutting speeds are available through an auxiliary switch. The supply of coolant is controlled by a valve which permits oil to flow to the work only while threading.

To obtain additional information on equipment described on this page, see lower part of page 656.

The pressure exerted by the six contact points of the chuck is adjustable to suit the wall thickness of the coupling, and is recorded on pressure gages at both the front and rear of the machine. The controls of all related moving parts are interlocked, thus protecting the machine and the operator.

The Style RES-L Namco positive-acting collapsing tap is used on these machines. For tapping 4-inch or smaller threads, these taps are equipped with flat type ground-thread chasers. For diameters above 4 inches and up to 13 3/8 inches, circular ground-thread chasers are used. By using only two tap bodies with demountable nose-pieces, core-pieces, tripping rings, chasers, and blocks, a complete range of couplings from 2 to 13 3/8 inches can be tapped.

The preceding description applies to machines equipped for tapping or finish-boring. When the machine is used for rough-boring, the lead-screw mechanism is replaced by an adjustable hydraulic valve control. Also, pilot bushings are required on both faces of the chuck plate. The indexing chuck and the means for positive alignment of the taper bore are retained. 51

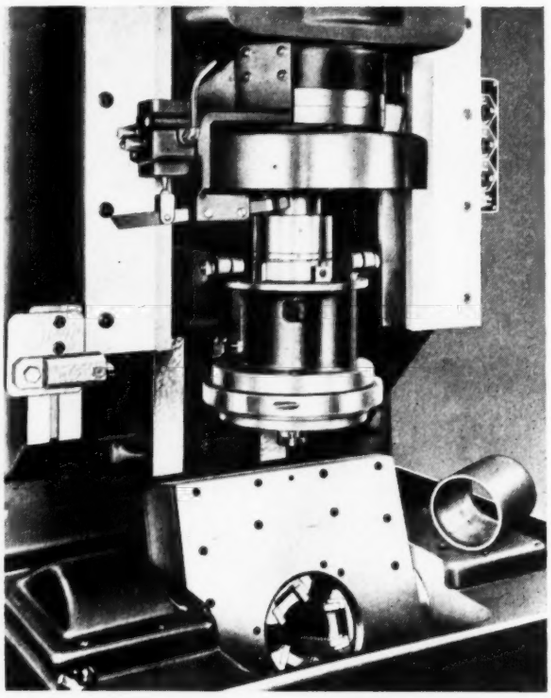


Fig. 2. Coupling Chuck on National Acme Machine, Shown in Partially Indexed Position

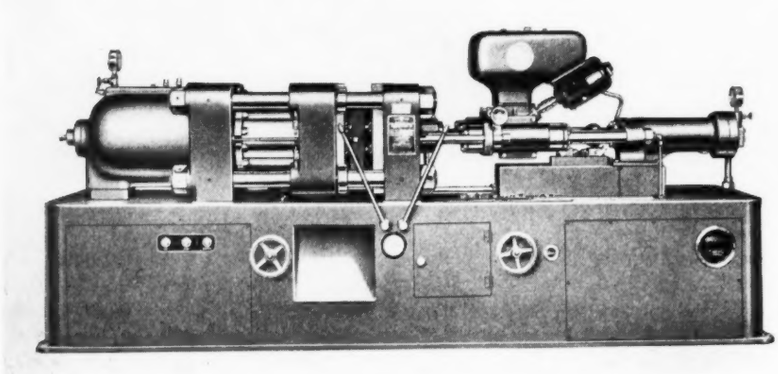
Hydraulic Injection Molding Presses

Injection molding presses, designated Models 200-H-7 and 200-H-9, with capacities of 7 and 9 ounces per "shot," respectively, are the latest developments in the line built by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio. These presses are similar in design and construction to previous models made by the company, but have several improvements developed to increase their efficieny.

These completely self-contained injection molding presses are of the horizontal clamp type, with the operating mechanisms totally enclosed, yet readily accessible. They are adapted for large and small production runs, being well suited for small job lots, as the molds can be changed quickly and no fine adjustments are required.

The power units in the bases of the machines are mounted on top of the reservoirs which contain the operating oil. A 15-H.P. double-end shaft motor, connected through flexible couplings to two high-pressure radial pumps operating at 2000 and 2500 pounds, drives the injection cylinder and the clamp system.

The molding material is heated indirectly with electricity through a circulating fluid medium, the heat being controlled through relays. The material hopper has a capacity of 50 pounds. The molding material is force-fed through passages by an automatically regulated feed-screw drive. Both presses are equipped with manual, semi-automatic, or full-automatic control. They have a clamping pressure of 200 tons. The maximum mold size is 16 1/2 by 24 inches, and the minimum shut height of the mold is 6 inches. The maximum opening between platens is 18 inches, and the maximum stroke of the mold-carrier platen is 12 inches. The plasticizing capacities per hour are approximately 40 and 50 pounds, respectively, for the H-7 and H-9 presses. The number of complete cycles per minute ranges from 4 to 6, depending on the size and type of the pieces molded. 52



Self-contained Injection Molding Press Built by the Hydraulic Press Mfg. Co.

Manhattan Duplex Welding Hose

The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., 44 Townsend St., Passaic, N. J., has developed a twin hose for welding equipment, designed to take the place of the separate oxygen and acetylene lines. This new hose, known as the "Condor Duplex," consists of two hose lines held together by a permanent web joint and integrally molded to provide strength and flexibility. The duplex construction prevents the hose from becoming entangled, kinked, or snagged while in use, thus making it safer and more efficient. The hose ends are separated 18 inches at the torch end and 24 inches at the tank end to facilitate handling and making connections.

The twin hose can be obtained in either one- or two-braid, or in heavy-duty braid and spiral cord construction to suit the working pressures employed. The corrugated covers are colored red and green to distinguish between the oxygen and acetylene lines. 53

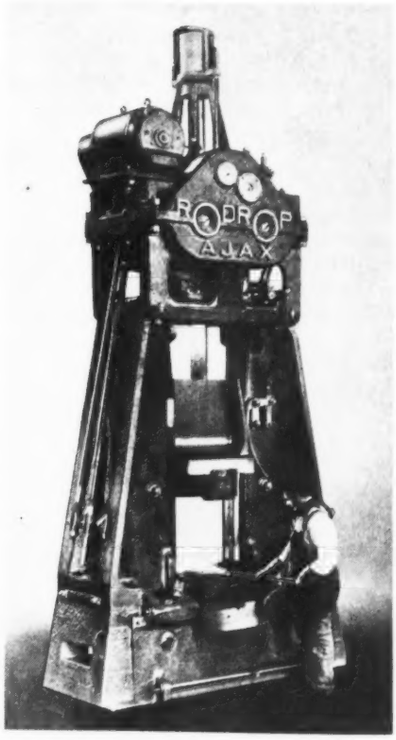
To obtain additional information on equipment described on this page, see lower part of page 656.

Ajax "Rodrop" Forging Hammers

A drop-forging hammer has been brought out by the Ajax Mfg. Co., Cleveland, Ohio, in which a heavy square steel lift-rod is employed in place of the conventional boards for lifting the ram. This rod is taper-fitted in the ram and located diagonally in the machine frame. It is acted upon by friction rolls with rims built up of laminated friction material grooved to make contact with the rod on all four sides. The transverse mounting of these friction rolls permits them to be made of relatively large diameter without overhanging the head frame. Consequently, they have a wide arc of contact with the rod, which results in low unit pressures and negligible wear.

The rolls are brought into and out of contact with the lift-rod through a rocking action of the eccentric hubs in which the roll shafts are carried. The rocking motion is obtained by means of a small air cylinder. A differential valve on the air line to this cylinder, governed by the amount the operator depresses the treadle, controls the height to which the ram is raised, and makes it possible to strike blows of varied force—that is, light, fast blows for fullering, and heavy blows for finishing.

On a full stroke, the top of the lift-rod is acted upon by an "accelerator cylinder," which is connected to the shop air line and gives the ram a quick acceleration or recoil, so that heavier blows are struck and in quicker succession than would be the case if the hammer were acted upon by gravity alone. The lifting mechanism is driven from a motor, mounted on a spring-cushioned platform, through V-belts to a fully enclosed flywheel. The gearing that drives the rolls is entirely housed within a gear-case which is integral with the head frame. These hammers are regularly made in 1500- to 6500-pound sizes, but larger sizes can be built to order. 54



Ajax "Rodrop" Forging Hammer with Friction-operated Ram

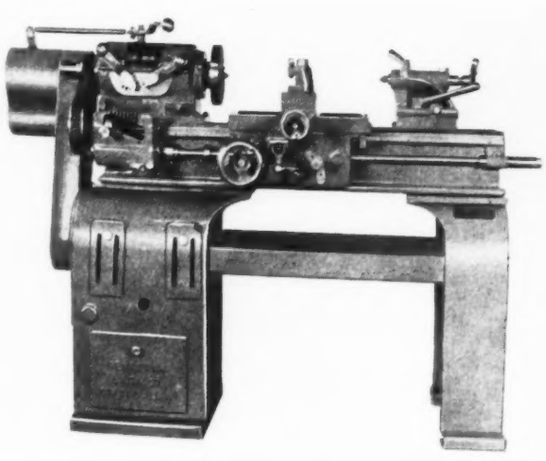
Sebastian High-Speed Lathe

A Type EV 12-inch lathe with Timken-bearing equipped headstock, which has eight spindle speeds ranging from 80 to 2000 R.P.M., and four rates of feed from 0.010 to 0.080 inch, has been brought out by the Sebastian Lathe Co., Cincinnati, Ohio. This lathe is especially adapted for machining aluminum, bronze, and similar metals. It is driven by a V-belt from a 2-H.P. motor located in the machine leg. A quick-stop brake is provided to save operating time.

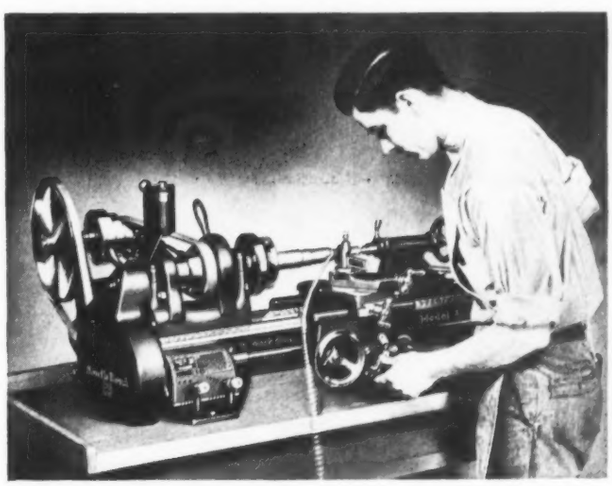
Stops for controlling the work diameter are employed on the cross-slide. An automatic adjustable safety stop is provided for use when feeding the carriage toward the headstock. A rear tool-block can be furnished, which can be controlled by the stops on the cross-feed. The collet capacity with the lever draw-chuck is 7/8 inch, and with the nose type draw-chuck, 1 5/16 inches. This machine is regularly made in three bed lengths, the 3-foot bed taking work 11 inches between centers, the 4-foot bed 23 inches between centers, and the 5-foot bed 35 inches between centers. 55

South Bend Work-Shop Lathes with Gear-Box and Automatic Apron

Two new models (A and B) have been added to the line of 9-inch work-shop precision lathes made by the South Bend Lathe Works, 775 E. Madison St., South Bend, Ind., to supplement the Model C lathe, previously placed on the market. The Model A lathe is of the quick-change-gear type and has an automatic apron with friction drive for operating the power cross and longitudinal feeds. The Model B lathe is of the standard change-gear type and also has an automatic apron with friction clutch drive for operating the power longi-



Sebastian Lathe Designed for High Spindle Speeds



South Bend New 9-inch Work-shop Lathe

To obtain additional information on equipment described on this page, see lower part of page 656.

tudinal feeds. An automatic safety interlock prevents engaging the power carriage feeds while the half-nuts are in use. The two new models are identical with the Model C lathe, except for the apron and change-gear equipment, the Model C lathe having plain change-gear equipment, power longitudinal carriage feeds through half-nut and lead-screw, and hand-operated cross-feeds.

The new quick-change-gear box developed for the Model A lathe provides forty-eight changes for cutting right- and left-hand screw threads having from 4 to 224 threads per inch. Metric thread cutting equipment can be supplied when desired. There are thirty-two power longitudinal feeds available, ranging from 0.0014 to 0.0208 inch per revolution of the spindle.

These work-shop lathes are made in both bench and floor types, with bed lengths of 3, 3 1/2, 4, and 4 1/2 feet. Several types of drives are available, including horizontal motor drive for bench lathes, pedestal motor drives for floor type lathes, countershaft drive, V-belt horizontal motor drive, and a twelve-speed motor drive. 56

Littell Motor-Driven Coil Cradle

A new type of cradle for flat coil stock has been brought out by the F. J. Littell Machine Co., 4149 Ravenswood Ave., Chicago, Ill., for handling coils weighing up to 3000 pounds. This coil cradle is regularly made to handle coils from 1 to 8 inches wide, but it can be built to suit any width requirements. It is driven by a 2-H.P. motor through a variable-speed drive.

The reel has a magnetic brake, which is applied when the loop formed during unwinding trips a limit switch at the rear of the cradle, thus stopping excessive over-run. Idling side-guide disks mounted on ball bearings rotate with the coil, thus preventing the stock edges from curling when thin material, around 0.015 inch thick, is being handled. A hand-straightening device for heavy stock, up to 1/8 inch thick, is provided to facilitate starting the front end of the coil stock into the power-driven straightener and roll-feed. With a variable-speed drive, the speeds can be adjusted so that the motor runs constantly, rebuilding the loop at the same rate that it is consumed. 57

Progressive "Multi-Duty" Spot-Welder

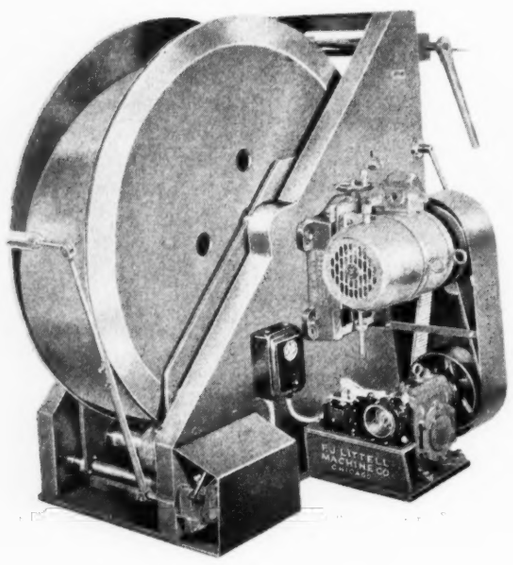
A "Multi-Duty" spot-welder, built around an entirely new design of welding head which employs a sliding contact, has been developed by the Progressive Welder Co., 737 Piquette Ave., Detroit, Mich. The welding guns of this equipment are mounted on the extreme ends of solid arms. Provision is made for mounting the guns either vertically or at an angle of 45 degrees. Special adapters for using guns in multiple and at various angles, or for projection welding, can be easily installed. The arms can be moved out to accommodate work up to 36 inches in depth, braces being available for the arms when used with the maximum throat adjustment.

Optional pressure systems consisting of a direct air unit which can be mounted on the upper welding arm or an air-hydraulic booster unit mounted in the head of the machine are available, the selection being dependent upon the maximum welding pressures required. In either case, the welder can be operated from the regular air-line pressures. Both types of actuating mechanisms are provided with pressure-regulating valves and direct-reading pressure gages.

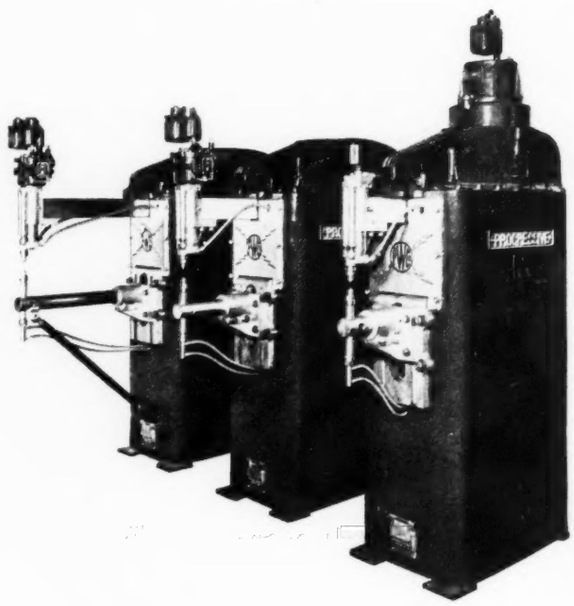
The heat and timing controls, the latter permitting an almost unlimited combination of single-spot, multiple-spot, or projection welds for any throat depth required, may be locked in the back of the machine to eliminate tampering or mounted externally for rapid adjustment. 58

"Select-O-Speed" Transmission with Handwheel Control

A new series of "Select-O-Speed" transmissions with handwheel control is being placed on the market by



Motor-driven Cradle for Handling Coils of Flat Stock up to 3000 Pounds in Weight



(Left) Multi-Duty Spot-welder. (Center) Welder with Arms Retracted. (Right) Welder Equipped for Heavy Work

To obtain additional information on equipment described on this page, see lower part of page 656.

the Ideal Commutator Dresser Co., 1011 Park Ave., Sycamore, Ill. These new models supplement the standard line equipped with lever controls described and illustrated on page 885 of August, 1938, MACHINERY. The handwheel is recommended where finer speed adjustments are necessary. The speed can be easily changed a few revolutions per minute by simply giving the control wheel a partial turn.

This type of control is especially desirable for installations requiring remote control. By replacing the handwheel with a set of bevel gears and an extension rod and universal joint, the point of control can be taken to any convenient position. This control is available on S-O-S variable-speed transmissions in sizes having capacity ratings from 1 1/2 to 7 1/2 H.P. 59

Taylor & Fenn Duplex Spline Milling Machine

A 4-inch duplex spline miller has recently been added to the line of machines built by the Taylor & Fenn Co., Hartford, Conn. This machine —the M-80—is designed to produce deep or shallow keyways on opposite sides of the same piece, or single keyways on two pieces simultaneously, as well as "through" slots or similar work, with a high degree of accuracy. High spindle speeds combined with the proper ratio of in-feed of the cutter and table travel make this machine particularly adapted for the use of small-diameter cutters.

With the exception of loading and unloading, this machine operates semi-automatically. The cutters can be set for the proper depth and the table adjusted for the length of cut required quickly and easily. This machine is intended for large-quantity production work, as well as for the milling of small quantities or single pieces. Complete electrical equipment for alternating current is installed in the machine, so that it can be readily attached to the plant power line. 60

Cincinnati Plain Automatic Milling Machines

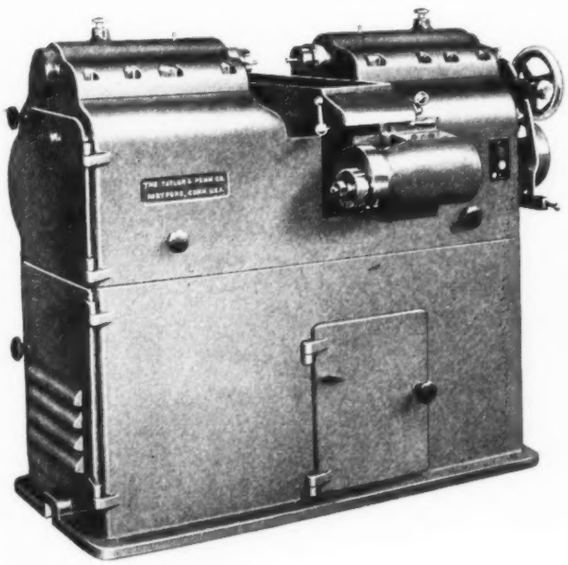
Two new plain automatic milling machines with power table traversing movements of 12 and 18 inches have been brought out by the Cincinnati Milling Machine Co., Cincinnati, Ohio. These machines have been designed for the rapid milling of a wide variety of small parts. A 3-H.P. motor with totally enclosed drive provides power for driving the machines. The machines have dog-controlled, automatic table cycles with intermittent feeds, a hydraulic backlash eliminator, an automatic spindle stop, screw feed to the table, and a finger-tip start-and-stop lever for the table movement.

The sixteen spindle speeds regularly obtained through heat-treated pick-off gears and a back-gear cover a range of from 50 to 1500 R.P.M. An alternate range of speeds, however, can be supplied. Means for reversing the spindle is provided. The spindle nose is National Standard with a No. 40 series taper hole. There is a quick hand adjustment and a clamping lever for the quill, which is graduated in 0.001 inch.

Sixteen table feeds ranging from 3/4 inch to 30 inches per minute are regularly available. A high series of table feeds from 1 1/2 to 60 inches per minute, and a low range from 1/2 inch to 21 1/2 inches per minute can be supplied. All feed changes are obtained by means of pick-off spur gears. Gears not in use are stored in a rack built into the motor cabinet. 61

Lincoln Electrode for Alternating-Current Transformer Welders

A new arc-welding electrode for use with alternating-current transformer type welders that have low open-circuit voltage is being placed on the market by the Lincoln Electric Co., Cleveland, Ohio. This new electrode, known as the "Readyweld," is a low-carbon steel rod with a heavy extruded shielded arc coating possessing properties that assure arc stability and easy restriking of the



Duplex Spline Milling Machine Developed by the Taylor & Fenn Co.

Plain Automatic Milling Machine Built by the Cincinnati Milling Machine Co.

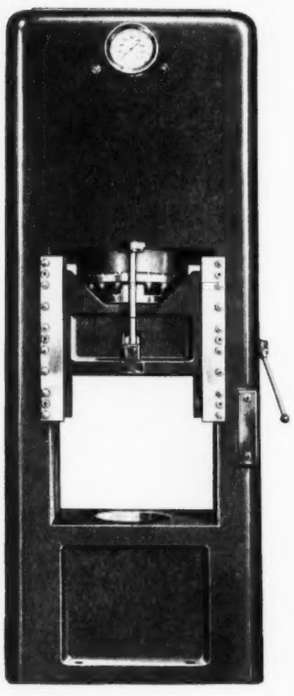
To obtain additional information on equipment described on this page, see lower part of page 656.

arc with small low-voltage transformer welders. It is intended for general welding and repair work on light-gage sheet steel, providing a weld metal of high strength and ductility. 62

French Hydraulically Operated Metal-Forming and Stamping Press

A motor-driven hydraulically operated press for metal forming and stamping, built in capacities of from 150 to 1500 tons and with different sizes of beds, has been brought out by the French Oil Mill Machinery Co., Piqua, Ohio. The hydraulic pump, all operating valves, and all pipe and fittings of this press are mounted within the head, which also serves as the reservoir for the hydraulic system. With this construction, the danger of pipe pressure leaks occurring outside of the press is eliminated.

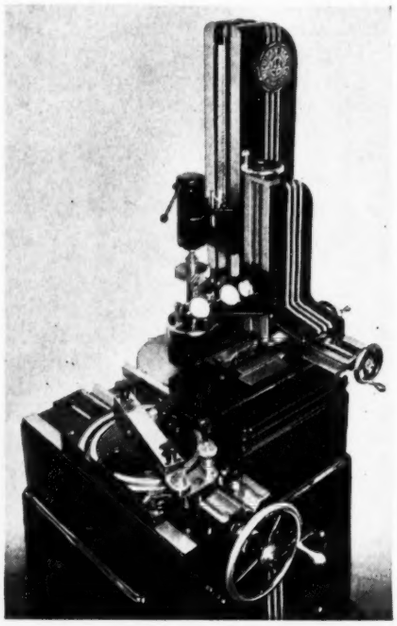
The press is controlled by push-buttons, a single hand-lever being provided, however, for controlling the speed and operation of the ram when setting up dies. The ram can be moved in either direction at any required speed or held stationary at any intermediate point by means of the hand-lever. 63



Hydraulically Operated Press Built by the French Oil Mill Machinery Co.

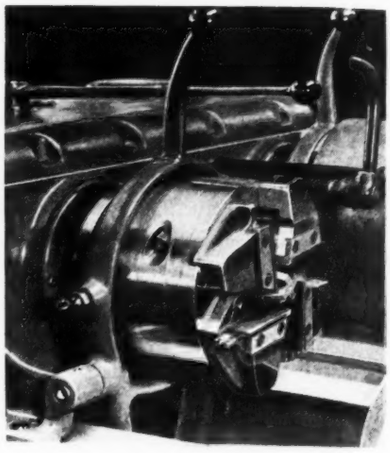
Michigan Gear-Tooth Checking Machine

The Michigan Tool Co., 7171 E. McNichols Road, Detroit, Mich., has just brought out a new model gear-tooth involute checker for production and laboratory use. An outstanding advantage of this new checker is reduction in set-up time, which makes it especially adapted for use where a variety of gears must be checked. The indicating head is designed to check gears from the pitch diameter, using a master rack tooth instead of the conventional pointer. With this arrangement, accurate depth adjustment of a pointer with relation to the base diameter of the gear being checked is unnecessary, the master rack tooth being merely moved into contact with the gear tooth. Tracing type fingers are also available.



Michigan Gear-tooth Involute Checker

The new involute checker has a full master base circle integral with the work-holding spindle, a feature that provides greater accuracy and better balance, and allows a wider range of rotation for the gear and work-spindle. The sine bar, which acts as a compensator for the difference between the length of arc of the master disk and of the base circle of the gear being checked—per degree of rotation—is mounted on a carriage adjusted by a lead-screw. A single eccentric clamp is provided on the tailstock, which permits the checker to be set up quickly for different gears and arbors. An elevating screw facilitates adjustment. 64



Landis Semi-receding Head for Cutting Tapered Pipe Threads

Landis Redesigned Head for Cutting Taper Threads

The Landis Machine Co., Inc., Waynesboro, Pa., has developed a new semi-receding pipe and nipple threading head for cutting tapered threads. A number of changes have been incorporated in the design of this threading head, but these changes do not affect the outward appearance. The operating mechanism has been redesigned, so that as the die-head advances under the cut, the end of the work will come in contact with the end of the reamer, and thus cause the chasers to recede, so that they produce a tapered thread.

This receding action of the chasers does not commence until after the first two or three threads are formed —hence the term "semi-receding" head. The reamer mechanism is employed to establish the total thread length, and since the reamer mechanism is not connected with the size adjustment mechanism, it is possible to adjust the die-head for size without affecting the thread length.

By using the semi-receding action rather than the full-receding action, the necessity for employing a lead-screw to propel the head forward is eliminated. The first two or three threads formed before the receding action begins are sufficient to provide a lead-nut action for the chasers. The manner of applying the chasers to the head provides the correct taper for the first two or three threads.

This arrangement provides a freer cutting action, which automatically reduces the cutting strain as the head advances, and is claimed to improve the quality of the thread, increase the accuracy of the taper, and lower power consumption. This new development is applicable only to Lanco

To obtain additional information on equipment described on this page, see lower part of page 656.

internally tripped pipe and nipple heads. Heads of this type now in use can be easily changed over to the semi-receding type. 65

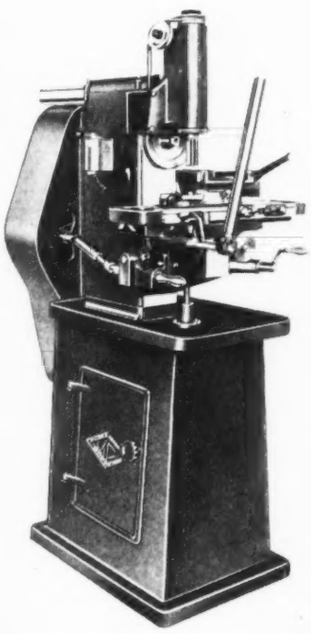
Holden Three-Phase Electrode Furnace

A three-phase electrode furnace having several new features has just been placed on the market by the A. F. Holden Co., New Haven, Conn. A new development prevents the current from passing to the pot wall, and no heat is generated in the rear wall of the pot. This construction prevents warpage of the pot wall toward the electrodes and thus insures longer life.

The three-phase unit provides electrodes in sets of three. The current density of the electrodes is 50 per cent lower than when electrodes are arranged in pairs. The advantages claimed for this furnace are increased electrode life and a low rate of change in the chemical composition of the bath. 66

Miller & Crowningshield Motor-Driven Milling Machine

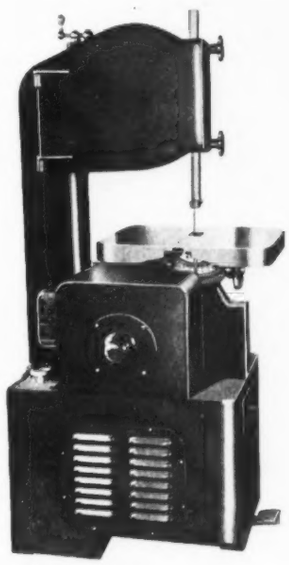
An improved motor-driven V-belt milling machine has been brought out by Miller & Crowningshield, Greenfield, Mass. Among the additions and improvements incorporated in this machine are a new fabricated all-steel base, power feed, and a V-belt driven vertical attachment with ball-bearing spindle using Hardinge collets. This ball-bearing spindle can also be used in the milling machine spindle with an adapter. 67



Miller & Crowningshield Improved Motor-driven Milling Machine

Grob Open-End Band Saw

A new open-end band saw designed for sawing out medium and small size dies, punches, stripper plates, and miscellaneous parts has been placed on the market by Grob Bros., Grafton, Wis. The set-up for internal sawing requires only fifteen seconds.



Grob Band Saw Equipped with Open-end Reversible Saw Blade

Since no welding of the blade is required, it can be easily removed from one opening and placed in another, ready for sawing. By using the saw blade as if it were a file, small intricate dies can be quickly finished within 0.001 to 0.002 inch of the line.

This machine, known as Model OS-14, accommodates saw blades 1/16, 3/32, and 1/8 inch wide. The blades are 150 feet long and are wound helically on a drum which has a thread groove. A multiple-speed motor drives the saw at the forward or cutting speeds, and a second motor provides the reverse drive at high speed. It takes only ten seconds to reverse the saw blade. The table tilts four ways and measures 20 by 20 inches. The throat is 14 inches, the distance from floor to table, 40 inches, and the weight approximately 1000 pounds. 68

Examining Weld in Steel Tank with Westinghouse X-ray Machine

Portable X-Ray Machine for Detecting Flaws

A 220-kilovolt portable X-ray flaw-detector has been developed by the Westinghouse Electric & Mfg. Co. and placed in service at the company's East Pittsburgh Works for examining structural welds and heavy castings on the production lines. The radiographic diagnosis of large steel parts is expected to be greatly simplified by this 4500-pound portable X-ray camera, since it can be wheeled along the production lines, where it is used to maintain the quality of the product during actual manufacture.

Wherever a suitable power supply is available, this machine will generate X-rays with a penetrating quality sufficient to pass through 3 inches of solid steel. The focussing mechanism is extremely flexible, permitting the apparatus to be aimed at a weld or a casting in either a horizontal or a vertical position. The X-ray tube, transformer, capacitors, and flexible focussing device are all compactly mounted on a chassis equipped with four balloon tires, automobile springs, and two mechanical brakes. With this equipment, two men can move the apparatus safely. 69

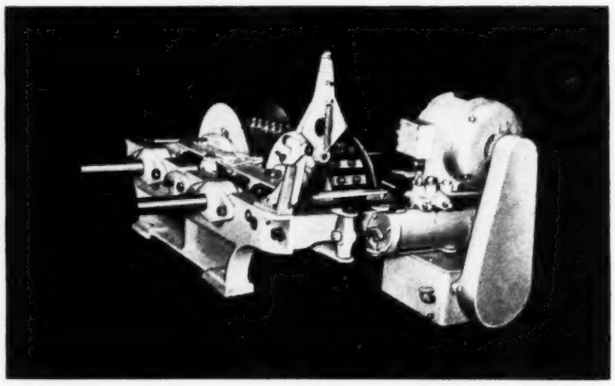
Wheelco Recording Thermometer

A thermometer designed to record accurately temperature variations in industrial installations over a range of from 0 to 1000 degrees F. has been brought out by the Wheelco Instruments Co., 1929-1933 S. Halsted St., Chicago, Ill. Charts for this instrument are available in a variety of forms, accurately calibrated for all

To obtain additional information on equipment described on this page, see lower part of page 656.

general industrial purposes. The charts are 11 inches in diameter and are calibrated over the entire scale range. Either a spring-driven mechanism or an electrically operated synchronous clock can be employed to rotate the chart.

The thermal system, consisting of a sensitive remote bulb, capillary connecting tube and Bourdon spring, contains a temperature-sensitive filling medium. When the bulb, placed at the point of desired temperature indication, is subjected to a temperature change, the sensitive filling medium expands or contracts immediately in accordance with the rise or drop in the temperature. This causes the Bourdon tube to actuate the pen-arm, which records the exact temperature on the chart. 70



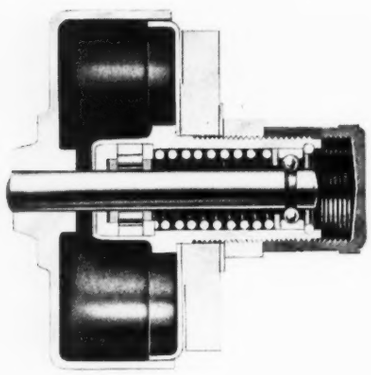
Reeves Variable-speed Transmission Equipped with New Hydraulic Control

SKF High-Speed Anti-Friction Idler Pulley

The SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa., have developed a free-running idler pulley unit for machines having light- and medium-duty high-speed belt drives similar to those used on textile spinning and twisting frames. Textile machines of this kind now employ more than 1,870,000 of these units. The idler pulley consists of a balanced standard or special pulley, provided with a dustproof cover that forms a protective seal for the high-duty roller bearing and the stabilizing ball bearing.

The ball bearing acts as an outboard bearing and insures surface-to-surface contact between the rollers and shaft at all times. In addition, the deep-groove ball bearing carries thrust loads, thus permitting the assembly to operate in either vertical or horizontal positions. A sufficient amount of grease for two years, or approximately 10,000 hours of operation is placed in the bearing when it is assembled at the factory.

These pulley units can be mounted directly on the machine frame or on several different types of swinging brackets. Five standard sizes of crown pulleys can be furnished with the unit, covering a range of from 2 3/4 inches by 31/32 inch up to 4 3/4 by 1 3/4 inches. 71



SKF High-speed Idler Pulley for Belt-driven Machines

Hydraulic Automatic Control for Reeves Variable-Speed Transmission

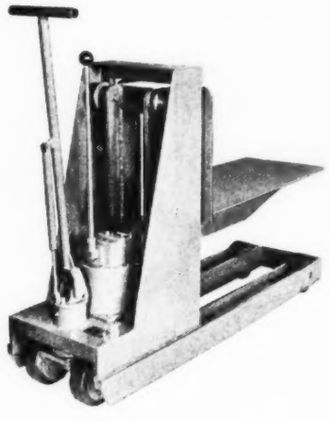
A new piston type hydraulic automatic control of simplified design, for use with the Reeves variable-speed transmission, has been brought out by the Reeves Pulley Co., Columbus, Ind. This control provides entirely automatic speed regulation, such as is required for the synchronization of different machines and separate units of a single machine; the maintenance of constant tension and uniform peripheral winding speeds; and the maintenance of uniform pressure, weight, liquid level, temperature, etc.

The control is located on the end of the transmission, so that the cylinder that houses the piston is connected to the right-hand set of shifting levers on the Reeves transmission, as shown in the illustration, the piston being connected by a rod to the left-hand set of levers. The self-contained hydraulic power unit of this control is mounted on the right-hand set of levers, in order to eliminate the necessity of using flexible oil connections between the oil-pump and the control valve. This power unit comprises a small electric motor, an oil-pump, and the oil reservoir that supplies the hydraulic power for operating the piston.

A two-way control valve is mounted on the cylinder, the housing of which is made integral with the cylinder casting. The two-way valve directs the flow of oil to either the right or left side of the piston, and thus increases or decreases the speed of the transmission. The control valve is actuated by a rod connected to an extended lever which can be attached by cable or chain, or directly, to a compensating roll, pressure regulator, moving carriage, or other part of the driven machine. 72

Lyon Truck with Hydraulic Elevating Table

A new line of trucks with hydraulic elevating tables has been developed recently by the Lyon Iron Works, Greene, N. Y. The trucks of this new line are of the cantilever type. This type of truck is used for maintaining skid loads of materials or parts at convenient heights for machine operators or assemblers. It can be furnished for caster steering and with or without brakes, in addition to the fifth-wheel steering cantilever type shown in the illustration. It can also be furnished in a toggle-

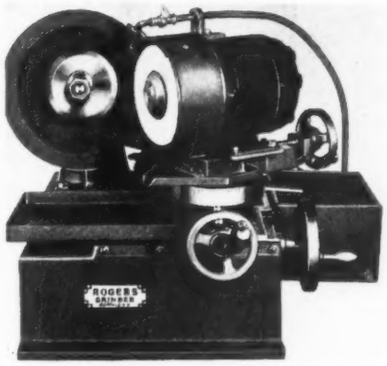


Hydraulic Elevating Table Truck Made by Lyon Iron Works

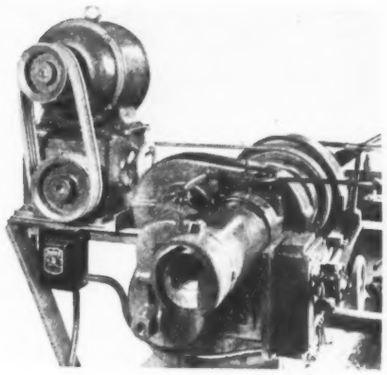
To obtain additional information on equipment described on this page, see lower part of page 656.

lever type with or without a winch for handling dies or rollers, and for sheets that must be supported at convenient heights for feeding.

Elevation of the load is obtained through hydraulic rams, actuated by a hand-operated Lyon single- or two-speed hydraulic pump or by a motor-driven pump. The standard sizes of the cantilever type trucks range in capacity from 350 to 5000 pounds. The widths of the platforms are from 18 to 36 inches, and the lengths from 24 to 60 inches. The lowered height ranges from 3 1/4 to 18 inches, and elevated heights are available to suit requirements. 73



Circular Knife Grinder Made by Samuel C. Rogers & Co.

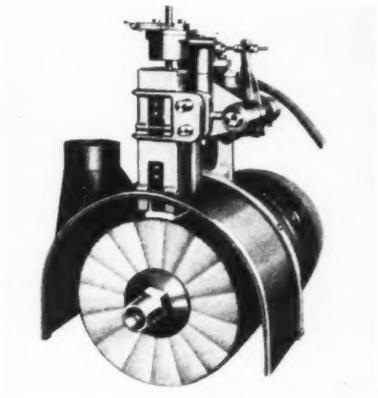


"Flexoid" Unit for Converting Belt-driven to Motor-driven Machines

Hammond "Auto-Doper" for Applying Composition to Buffing Wheels

The "Auto-Doper" here illustrated has been developed by Hammond Machinery Builders, Inc., Kalamazoo, Mich., for automatically applying composition or "dope" to the wheels used on buffing lathes and semi-automatic and automatic buffing equipment. The head of the device oscillates, so that the bar of composition is applied to the wheel momentarily. As the composition is brought into contact with the wheel intermittently, the stream of air generated by the revolving wheel keeps the composition cool.

This device is operated by compressed air through a three-way valve. On machines with a conveyor unit, particularly semi-automatic buffing machines and polishing lathes, the application of the composition can be timed or synchronized with the conveyor by an electric device or a foot-operated valve. In the latter case, the operator simply steps on the foot-treadle when composition is to be applied to the wheel. 74



Hammond "Auto-Doper" for Applying Composition to Buffing Wheels

Rogers Circular Knife Grinder

To meet the need for a low-priced precision machine for grinding all kinds of single or double circular knives from 1 to 8 inches in diameter, Samuel C. Rogers & Co., 191-205 Dutton Ave., Buffalo, N. Y., has placed on the market a machine designated the C1. The illustration shows this machine equipped with a wet grinding attachment, but it can be furnished without this attachment for dry grinding. Adjustments can be made to meet all the requirements for circular knife grinding by means of three slides equipped with handwheel, screw type controls. A graduated swivel device insures correct angular grinding. The same angle is maintained, regardless of grinding wheel wear or change in the size of the knife.

A 6- by 1/2- by 1/2-inch grinding wheel is used on a 1/4-H.P. totally enclosed, direct motor-driven arbor mounted on ball bearings, which is adjustable to eliminate end play. The knife is rotated by a separate motor through a V-belt drive. A knife with an arbor hole as small as 1/4 inch can be accommodated. Bushings are furnished for knives with larger center holes. 75

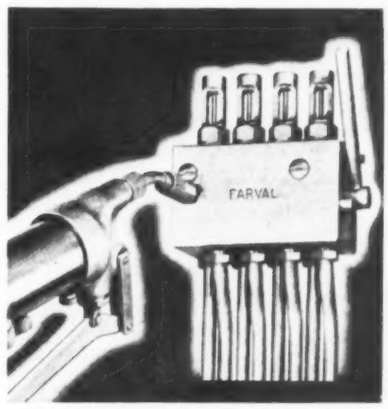
"Flexoid" Speed Control Unit

The Smith Power Transmission Co., 410 Lakeside Ave., N.W., Cleveland, Ohio, has brought out a speed control unit known as the "Flexoid." This unit is designed for use in converting group-driven and belt-driven machine tools into individual-motor-drive machines with characteristics as nearly as possible like those of the gear-in-head tools. The new unit is self-contained, and has a single hand control for all ratios, with a neutral position between each change of speed. The control can be arranged for operation from a remote position at slight additional cost.

The parallel input and output shafts are ball-bearing equipped. Reverse control with a set ratio can also be provided. The "Hi-Lo" pulley can be used to give variable control over the different speeds. 76

Farval Lubricating System with Multiple Measuring Valves

A new system for lubricating small machines or a few bearings on large machines from a single grease inlet has been developed by the Farval Corporation, 3250 E. 80th St., Cleveland, Ohio. The unit designed for applying this system consists of a multiple measuring valve block with a single inlet port and from two to eight lubricant outlets per block. As many valve blocks as are necessary to lubricate all the bearings on a machine can be installed and connected in series.



Valve Block which Measures out and Delivers Grease to Several Bearings

To obtain additional information on equipment described on this page, see lower part of page 656.

The positive pressure lubrication of every bearing is accomplished by connecting a conventional hand or power grease gun to the inlet port of the unit, as shown in the illustration, and moving the rotary valve handle. When the rotary handle on the unit is moved to one position, lubricant pressure moves the valve pistons in one direction, delivering lubricant to one set of outlets. When the valve handle is moved to the opposite position, the valve pistons move in the opposite direction, delivering lubricant to the other set of outlets. Movement of the tell-tale indicator stem attached to each valve piston indicates that each bearing has received its measured amount of lubricant. The amount of lubricant delivered to any pair of outlets can be individually adjusted. 77

Lincoln Arc Welder with Dual Continuous Control

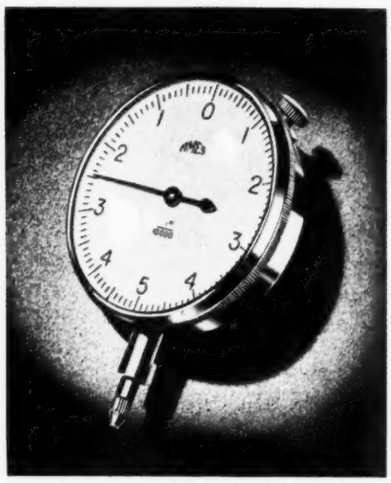
A small motor-generator type arc welder which is said to provide greater convenience and accuracy in welding because of a new self-indicating dual continuous current control has been brought out by the Lincoln Electric Co., Cleveland, Ohio. This unit is especially adapted for welding in repair shops, sheet-metal shops, garages, bus and truck fleet repair shops, and in maintenance departments of large manufacturing plants generally.

This SA-150 welder has both the job selector and current control calibrated and equipped with dials that indicate the type of work and number of amperes required for each setting. It is claimed that this development enables the welding operator to secure the highest quality welds and the highest possible welding speeds, because he can vary the amount of welding current independently to suit each job. This welder is driven by a "Linc Weld" squirrel-cage induction type motor for across-the-line starting. Connections are readily accessible for either 220 or 440 volts, two or three phase, 50 or 60 cycle, as desired. The machine can also be supplied for 550 volts or special voltages. 78

Lincoln Small Motor-generator Arc Welder

Ames Dial Indicators

Four new dial gages, with cases ranging from 1 1/4 to 3 1/4 inches in diameter, have been placed on the market by the B. C. Ames Co., Waltham, Mass. These new jewelled, dial indicators are sensitive to 0.000010 inch and accurate to 0.000025 inch, with a spindle travel of 0.020 inch. All four models are also made with a spindle travel of 0.100 inch, while the larger sizes are available with spindle travels up to 0.500 inch.



Dial Indicator Made by B. C. Ames Co.

The pinions and staffs are of hardened and ground steel, and all staffs have sapphire jewel bearings. Carbide-tipped contact points are used to resist wear. The gages are chromium-plated throughout. 79

Service Mechanical Lift Type Die Table

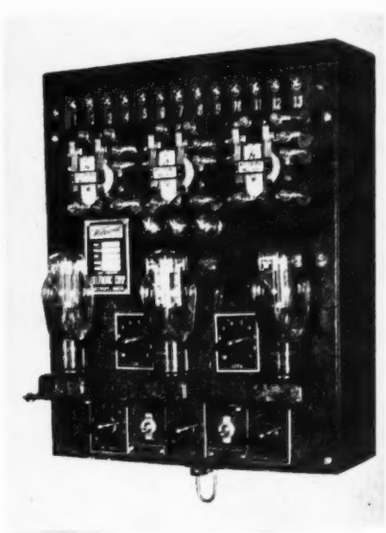
A die table with a new type mechanical chain-and-screw lift has just been placed on the market by the Service Caster & Truck Co., 820 N. Brownswood Ave., Albion, Mich. This new table or truck is of all-steel electrically welded construction. The top is of 3/16-inch steel plate and has a surface 26 by 43 inches.

Service Mechanical Lift Type Table for Moving and Handling Dies

A cam arrangement which is operated by a twist of the wrist locks the table rigidly in place. When lowered, the top of the table is 28 inches from the floor, and, when fully raised, the height is 42 inches. This table is made in a 2000-pound capacity model with a lift chain, and a 1250-pound capacity model with a cable lift. It can be built to order in capacities up to 5000 pounds. 80

Weltronic Electric Welding Timers

The Weltronic Corporation, Detroit, Mich., has recently placed on the market a new line of electronic welding timers. These timers have been in successful operation in a number of plants during the past year on experimental installations handling regular production work. They are designed for use with gun,



Electric Welding Timer Made by the Weltronic Corporation

To obtain additional information on equipment described on this page, see lower part of page 656.

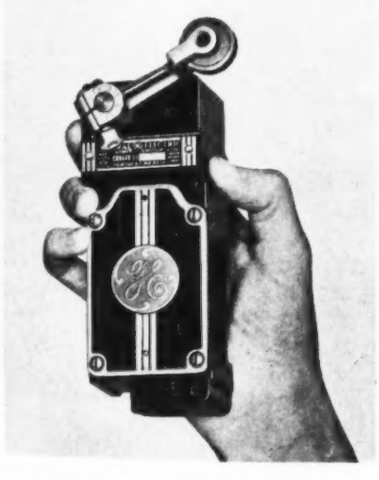
spot, projection, and automatic welding equipment. The line comprises models ranging in their application from single spot to multiple-automatic spot welding. Up to 600 spot welds per minute have been made on regular production work.

The line includes timers for controlling the start of the welding current, which may be either interlocked with a pressure control switch or actuated through a separate "delay" relay; setting of cut-off time of the welding current; "cooling" time, which regulates the length of time the electrodes remain in contact with the work after the welding current has been cut off to permit annealing the work; the number of interruptions of the welding current during the welding operation, which permits spot-welding section up to 1/2 inch thick; length of welding time in cycles; and time delay before welding current goes on after the electrode pressure has been built up. 81

General Electric Snap-Action Limit Switch

A small, snap-action limit switch designed for use on machine tools, conveyors, and other automatic equipment has been placed on the market by the General Electric Co., Schenectady, N. Y. The new switch was developed to meet the requirements for an inexpensive limit switch of small size which will operate slowly without burning the contact points and be oil- and dirt-proof. It can be mounted for operation in practically any position.

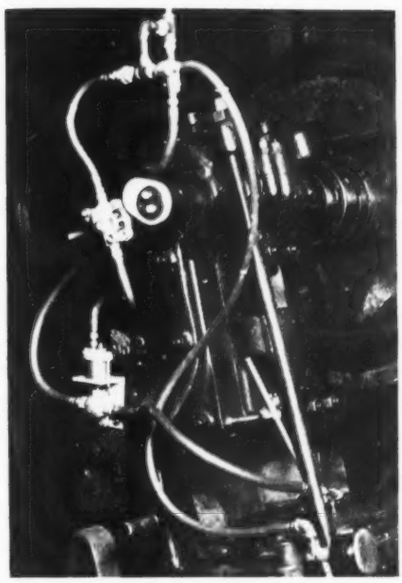
Silver-to-silver double-break contacts are employed to insure long life, while two independent circuits provide for any contact arrangement required. The positive snap action is obtained by means of an over-center toggle mechanism. The switch can be supplied with either a roller-lever or push-rod head. 82



Snap-action Limit Switch Designed for Use on Machine Tools

Valve for Controlling Work-Ejecting Air Blast

A "pilot" valve has been developed by A. Schrader's Son, Division of Scovill Mfg. Co., Inc., 470 Vanderbilt Ave., Brooklyn, N. Y., for controlling the air blast used to eject work from a press. This valve is designed to give a delayed or prolonged blast of air for ejecting work from the press after the ram has ceased its upward motion. It is especially designed for hand-fed presses employing overhead knock-out or compound dies.

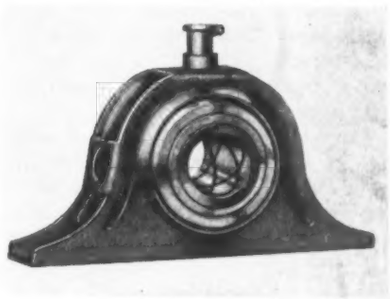


Schrader Pilot Valve Applied to Punch Press

The duration of the air blast is regulated by a simple screw adjustment on the valve. The valve can be easily serviced, conserves air, and eliminates the necessity of interchanging machine parts to obtain the advantages of a timed air blast. With the vent closed, the device can be used as an air control valve for any mechanism. 83

Randall Pillow Block

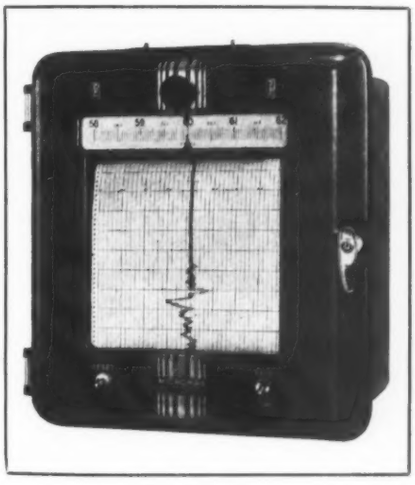
A new light-weight, low-priced pillow block has recently been placed on the market by the Randall Graphite Products Corporation, 609 W. Lake St., Chicago, Ill. This pillow block, as shown in the accompanying illustration, consists of only three parts. It has been designed to provide increased oil capacity, assure constant self-alignment, and run quietly. It is available in shaft sizes of from 1/2 to 1 inch, and can be mounted in any position. 84



Randall Pillow Block with One-piece Steel Housing

Leeds & Northrup "Micromax" Frequency Controller

A new "Micromax" frequency controller of the industrial type, designed to provide isolated electric generating plants with automatic control of the current frequency, such as was previously thought feasible only for large central stations on inter-connected systems, has been brought out by the Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa. This controller consists of the "Micromax" frequency indicator made by this company and a recorder with an automatic controller, combined in one compact case. This ar-



"Micromax" Frequency Controller for Small Power Plants

To obtain additional information on equipment described on this page, see lower part of page 656.

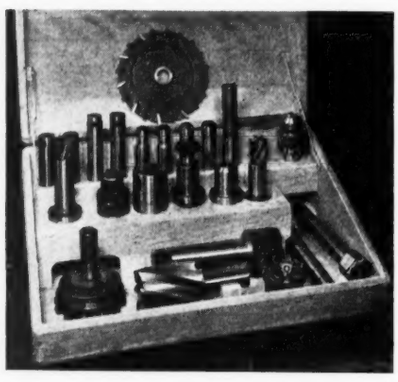
rangement provides a simple, relatively inexpensive unit in which the refinements necessary for large central stations on inter-connected systems are omitted.

The automatic control regulates the frequency by sending correcting impulses to the governor motor on the prime mover, thus changing its input. This instrument detects normal frequency departures long before they become large enough to be observed on the station's frequency-indicating meters, and having found these variations, the instrument proceeds to make the necessary corrections at once. The frequency measuring circuit is sensitive to 0.01 cycle and can be set to make corrections every two seconds, if required. 85

Boring-Bars and Adapters, and Bronze Stock-Pushers

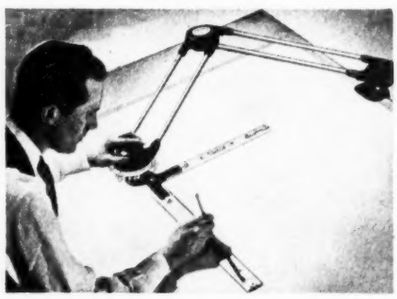
A complete set of boring-mill bars and adapters has recently been added to the line of the Modern Collet & Machine Co., Ecorse, Mich. This set, designated the "Modern Quick-Change Boring Mill Set," is assembled in a box, as shown in the illustration. After a boring-bar has been set for boring a hole, it can be removed from the holder and replaced in exactly the same position, thereby assuring accurate work with a minimum amount of checking.

The cutter-holding bars are so designed that the end-cutting, side-cutting or shear-cutting tools cannot work loose or change their positions during the cutting operations. The tool-bit holes are at right angles to the bars, permitting bosses to be spot-faced by a straight tool. The tools in this set, including all sizes up to an 8-inch face mill, can be operated efficiently without sacrificing any of their quick-change features. Any of the boring-bars and adapters in this set can be interchanged in the chuck in approximately five seconds.



Quick-change Boring-mill Set Made by Modern Collet & Machine Co.

Another recent development announced by this company consists of bronze pushers for feeding bar stock. These pushers are identical with the standard line of this company's manufacture, except that they are made of a special bronze. They will retain the proper spring tension for feeding the stock, and yet, because of the anti-friction properties of the bronze, will not scratch the stock. 86

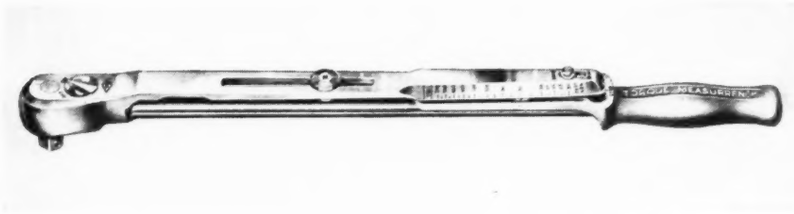


"Excello" Drafting Machine Brought out by Eugene Dietzgen Co.

"Excello" Drafting Machine

The "Excello" free-floating drafting machine recently brought out by the Eugene Dietzgen Co., 2425 N. Sheffield Ave., Chicago, Ill., is designed to enable the draftsman to work with as little strain as possible, and thus with greater accuracy. The free-floating feature is obtained by the use of light-weight alloys, roller bearings, and precision construction, together with a method of "gravity control" that eliminates drag and permits the machine to be used on inclined drafting boards.

The protractor head is so designed that the control of angles is placed directly under the thumb. All moving parts are completely enclosed for protection against dust and handling. The machine is finished in non-glaring satin aluminum and black. It is made for use on drawings up to 36 by 60 inches, and is available with a standard or a civil engineer's protractor head. It will take all standard scales with chuck plates. 87



Williams "Torque Measurrench" with Calibrated Scale

Williams Torque "Measurrench"

J. H. Williams & Co., 225 Lafayette St., New York City, have brought out a new reversible ratchet type wrench known as the No. S-57 "Torque Measurrench," which indicates the torque applied when the wrench is turned in the right-hand direction. There are two different ways of controlling the torque applied, either by the sight or the sound method. In using the sight reading method, the applied pressure of the wrench is read at the point where the index shoulder crosses the scale, which is calibrated to show applied pressures of 20 to 200 foot-pounds. With the sound reading method, a simple sound device is set to give a sharp sound signal for any torque from 35 to 200 foot-pounds.

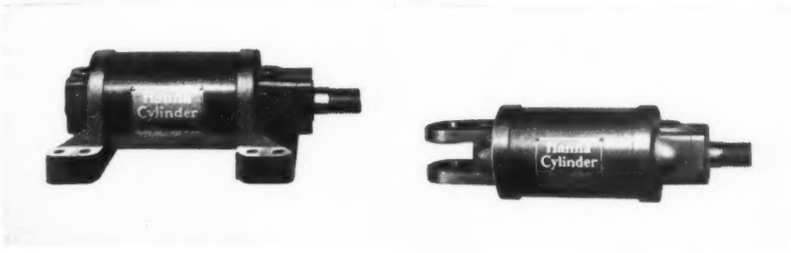
The 36-tooth ratchet wheel, with a patented twin double-tooth pawl makes possible the unusually short operating swing of one-thirtieth of a full turn. The wrench action can be instantly reversed by a flip of the shifter lever, which is flush with the head.

All parts of the wrench are accurately machined from alloy and high tensile strength steel and are heat-treated. The wrench is chromium-plated; the top and sides of the head and the calibrated bar are buffed, while the handle has a "satin" finish. The wrench is 19 1/2 inches long, and can be used with any detachable socket having a 1/2-inch square drive opening. 88

Hanna High-Pressure Cylinders

The Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill., has brought out a new line of high-pressure cylinders designed for a maximum operating pressure of 1500 pounds per square inch. These cylinders are available with ten different types of mounting, and in diameters ranging from 1 1/2 to 8 inches. All cylinders are equipped with cushions in both heads. The

To obtain additional information on equipment described on this page, see lower part of page 656.



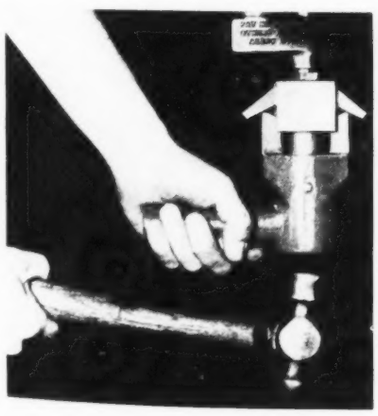
Hanna High-pressure Cylinders Made with Ten Different Types of Mounting

cushions prevent harmful metallic impact in the cylinder and shock in its mounting, but their more important function is to prevent hydraulic shocks or "water hammer," which often opens joints, bursts tubes, ruins gages and upsets pressure responsive controls.

Ample air-vent plugs are provided, so that regardless of the location of the inlet ports, there is always an air-vent plug on the upper side of the cylinder head. An important point in the design is that the over-all dimensions of the cylinders have been reduced to a minimum. 89

Device for Removing Spot-Welder Taper Points

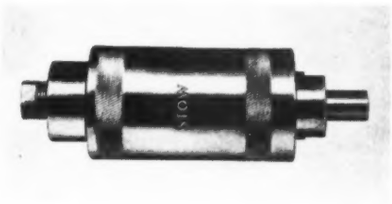
A simple puller for removing taper points from their sockets in hydromatic and multiple spot-welders, is now being made by the Progressive Welder Co., 737 Piquette Ave., Detroit, Mich. This taper-point puller is designed to provide automatic locking, with no slipping or scoring of the electrode. This device is designed to prevent damage of the welding point seats, as well as the points. The puller jaws are slipped over the electrode, after which a slight lift of the handle serves to seat the jaws. A tap with a hammer on the bottom of the puller then serves to remove the electrode from the holder. This puller is available in sizes to fit points having Morse tapers Nos. 1, 2, or 3. 90



Device for Removing Taper Points from Spot-welder Sockets

Stow Reciprocating Hand-Piece for Flexible Shafts

A hand-piece for use on flexible-shaft power drives which converts the rotary motion of the flexible shaft into a reciprocating motion having a stroke of 1 inch is being made by the Stow Mfg. Co., Inc., Binghamton, N. Y. This hand-piece will operate files and saw blades having 1/4-inch shanks, and is especially adapted for use in making dies and metal patterns. It is designed to operate at speeds not exceeding 1000 R.P.M., and is interchangeable, in the same size range, with other flexible-shaft attachments. 91



Stow Hand-piece for Converting Rotary Motion of Flexible Shaft into Reciprocating Movement

Automatic Hydraulic Reversing Valve

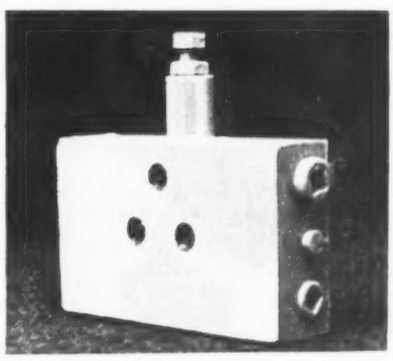
An automatic reversing valve for use in conjunction with a pump and a continuous reciprocating double-acting hydraulic cylinder motion on a closed hydraulic circuit is being placed on the market by Seward & Walcutt, 189 Montague St., Brooklyn, N. Y. This valve operates one or more cylinders of varied length and diameter, in parallel, the cylinder with the least resistance moving first, followed by each cylinder in the order of its resistance. When the cylinder or cylinders have completed their strokes, the valve reverses the cycle at any desired pressure. The stroke of each cylinder is readily adjustable.

A test unit was used on a ram type stroke for one and one-half years with no failure or replacements. The device eliminates cylinder jamming, gives any desired stroke, and is practically noiseless in operation. It shows almost no pressure loss, permits no stalling or stopping on centers, and is designed to provide a low-cost motion for controlling the operation of planers, presses, and many other machines requiring reciprocating or rotary motion. A continuous rotary motion can also be obtained with this equipment when required. This valve is available in 1/4- to 3/4-inch pipe sizes, for pressures up to 1000 pounds. Larger sizes can be built to specifications. 92

* * *

A 40 Per Cent Saving in Factory Lighting Costs

An installation of Pyranol transformers to obtain adequate power for the proper lighting of a new production lay-out in the Pittsfield, Mass., plant of the General Electric Co., is said to produce the illumination desired at savings of approximately 40 per cent, compared with systems using conventionally located transformers of the oil-filled type. The new system, believed to be the first installation of its kind, uses Pyranol transformers at properly located distribution centers. The saving was obtained mainly by the utilization of existing secondary copper and conduit, because the transformers, filled with the non-inflammable and non-explosive Pyranol, could be located near the points of application of the electrical energy.



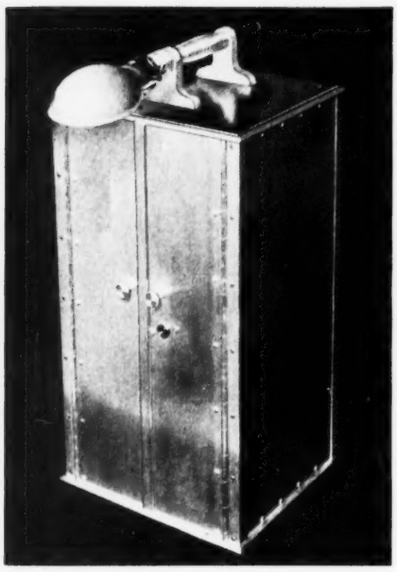
Automatic Reversing Valve for Double-acting Hydraulic Cylinders

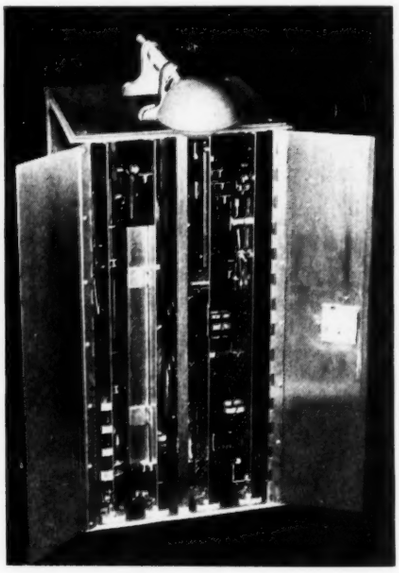
To obtain additional information on equipment described on this page, see lower part of page 656.

Aluminum Tool Chest of Novel Construction

The outstanding feature of a novel tool chest designed and built recently by F. T. Mulligan, Aluminum Research Laboratories, Box 772, New Kensington, Pa., is the saving in space obtained by using vertical panels, as shown in Figs. 2 and 3. Tools can be located on both sides of each of the four panels, properly spaced supporting blocks being used to hold the tools in place. It will be noted that the panels have rows of holes for attaching the tool-holding blocks wherever required.

The panels are so arranged that they can be pulled out and swiveled or turned like the leaves of a book to permit quick selection of tools. The tool chest is shown with the doors closed in Fig. 1, and with the doors opened and the panels pulled out in Fig. 3. Fig. 2 shows the doors open and the panels pushed back in place so that the doors can be closed. The handle of the tool chest serves as a holder for a telescoping and swiveling electric light bracket. The chest is made of aluminum, and is 4 pounds lighter, when empty, than the ordinary tool chest. There is also twice as much tool space in a chest of this design as there is in an ordinary tool chest having the same outside dimensions.





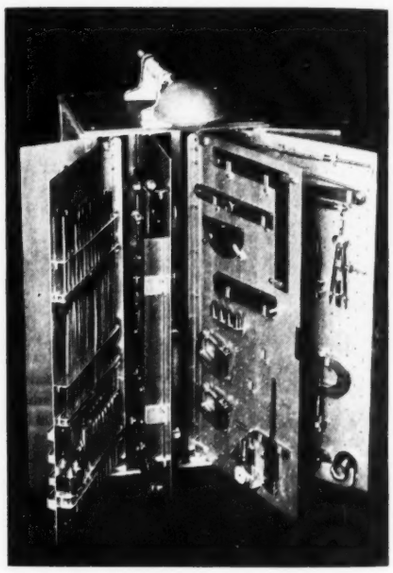


Fig. 1. (Left) Aluminum Tool Chest with Electric Light Mounted on Carrying Handle. Fig. 2. (Center) Tool Chest with Doors Open. Fig. 3. (Right) Panels of Tool Chest Pulled out and Opened Like the Leaves of a Book to Permit Quick Selection of Tools

The Effect of the Machine on Employment and Standard of Living

A preliminary report of the American Society of Tool Engineers' Fact-Finding Committee on the effect of the development of the machine on employment and standard of living was presented at the annual meeting of the Society in Detroit, March 13. This report, which is now available in printed form, carries the title "Machines and Tools Create Employment." It contains a wealth of data on this subject, indicating how industrial employment has increased at a greater ratio than the increase of population during the period in which the use of machines and tools has so greatly expanded. The report also contains a valuable bibliography of books and articles that have been published on the subject. John Younger, professor of industrial engineering, Ohio State University, is chairman of the Society's Fact-Finding Committee.

American Foundrymen Meet

The forty-third annual convention of the American Foundrymen's Association will be held in Cincinnati, Ohio, beginning Monday, May 15. A comprehensive program has been planned for the meeting, almost all subjects relating to the foundry industry being covered by one or more papers. In all, more than sixty papers will be presented, dealing with malleable cast iron, non-ferrous castings, gray iron foundry practice, materials handling, apprentice training, safety and hygiene in the foundry, refractories, time study, steel castings, sand research, foundry costs, melting practices, and patternmaking. Plans have also been made for extensive visits to some of the outstanding foundries in the Cincinnati district.

* * *

Effect of Speed on Wear of Automobile Tires

According to the Automobile Manufacturers' Association, tests indicate that rear tires on an automobile give twice as much mileage when the car is driven at 55 miles per hour as they do if the car is driven at 70 miles per hour. The front tires last nearly two and one-half times as long at the lower of the two speeds.